



UNITED STATES
NUCLEAR REGULATORY COMMISSION

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October 7, 1994

MEMORANDUM TO: Ashok C. Thadani, Associate Director
for Inspection and Technical Assessment
Office of Nuclear Reactor Regulation

FROM: Gary M. Holahan, Director *G. M. Holahan*
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SUBJECT: ACTION PLAN TO MONITOR, REVIEW, AND IMPROVE FUEL AND CORE
COMPONENTS OPERATING PERFORMANCE

The attachment, "Action Plan To Improve Core Performance," addresses the review of fuel fabrication, core design, and reload analysis issues that were discussed during the March 29, 1994, briefing given to James M. Taylor, Executive Director for Operations. The briefing presented by the Reactor Systems Branch (SRXB), Division of Systems Safety and Analysis (DSSA) covered generic fuel and core performance issues and related evaluations of fuel failures. Representatives of the Vendor Inspection Branch (VIB), Division of Reactor Inspection and Licensee Performance (DRIL) participated in the briefing. As a result of this briefing, the Office of Nuclear Reactor Regulation (NRR) was requested to prepare an action plan for a proactive approach to improve core performance in operating reactors.

Preliminary root cause evaluation of core performance problems points to inadequate analysis and testing of new core designs, nuclear fuel vendor manufacturing problems, less-than-adequate licensee oversight, and weaknesses in the vendor-licensee interface execution.

The proposed action plan contains a description of core performance issues, causal factors, current activities, and a description of the proposed actions to improve core performance. The detailed schedule milestones and resource estimates, based on conducting inspections of four manufacturers and four licensees/plants by the end of FY-95, are also given in the proposed action plan. The plan is categorized into the following four task actions:

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IDAR-5-ACTION PLAN

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- Task 1 - Inspections of Nuclear Fuel Vendors
- Task 2 - Inspections of Licensee's Reload Analysis
- Task 3 - Core Performance Data Gathering and Evaluation
- Task 4 - Regional Participation in the Action Plan To Improve Core Performance

Taken together, these four interrelated tasks address NRR's concerns regarding the adequacy of safety analyses for mixed core reloads and support the resolution of high burnup and extended cycle length issues. For example, the results of Task 1, "Inspections of Nuclear Fuel Vendors," will provide background information, developed by conducting performance-based inspections of the vendors, for use during the vendor-licensee interface reviews addressed in Task 2, "Inspections of Licensee's Reload Analysis."

The inspection goals are to conduct an inspection of each fuel vendor once every 12 to 18 months and conduct, on an annual basis, an inspection of one licensee reload analysis per region. The nuclear fuel vendor and licensee/plant performance-based inspections will be initially conducted on the basis of Draft Inspection Manual Chapters (IMCs) for each inspection type. Lessons learned from the inspections will be used to finalize the IMCs at the completion of the planned activities for FY 95. The initial FY 95 actions form the basis of a pilot program that will be evaluated for future implementation as IMCs.

Table 5, "Preliminary Schedule for the Inspections of Nuclear Fuel Vendors and Licensee's Reload Analysis," describes the proposed FY 95 schedule for Task 1 inspections of fuel vendors and core component manufacturers and the Task 2 inspections of licensee's reload analysis. To determine the initial licensee/plant inspection priorities for the first inspection in each region, SRXB will select the licensee/plant from a fully developed Table 6, "Licensee/Plant Core Design and Reload Analysis Responsibilities and Status." The attached sample table is currently under development with input from the regions. When completed with Tasks 3 and 4 input, it will summarize by region and licensee, the licensee-vendor core reload design analysis responsibilities and interfaces and highlight recent core performance issues.

Task 3, "Core Performance Data Gathering and Evaluation," consists of the identification, documentation, and categorization of core performance problems and root cause evaluations that will be further evaluated during the inspections conducted in Tasks 1 and 2. It also provides for generic documentation and inputs for the final IMCs.

Task 4, "Regional Participation in the Action Plan To Improve Core Performance," consists of training and coordinating the regional support staff participating in both the Tasks 2 and 3 activities.

For the Task 2 inspections of the licensee/plant reload analysis, SRXB plans to lead the first inspection in each region and subsequently assist region-led inspections, as requested. Each SRXB-led inspection team will consist of a member from SRXB, a member from VIB, members from the region, and one TA. TA costs are estimated at \$10,000 to \$20,000 for each licensee/plant inspection.

Successful achievement of the planned inspection goals shown in the attached action plan is dependent on NRC management commitments in the following areas: (1) available and dedicated resources from VIB, SRXB, and the regions to support the teams described above and the task activities described in the action plan and (2) available and funded TA support. The current VIB and SRXB advanced procurement plans (APPs) for FY 95 included \$400,000 (VIB - \$250,000; SRXB - \$150,000) for fuel vendor and core performance-related activities contracted TA support. VIB's TA funding for FY 95 appears adequate to fully implement the action plan. However, to fully implement its portion of the four tasks in the proposed action plan, SRXB requests an additional \$342,000 in TA funding over the currently budgeted APP amount.

On the basis of your approval, SRXB will budget additional funds accordingly; VIB and SRXB will commence development of inspection plans based on the tasks described in the attachment, and VIB and SRXB will coordinate, as appropriate, the implementation of the action plan with Program Management, Policy Development, & Analysis Staff (NRR/PMAS); Inspection & Licensing Policy Branch (NRR/ILPB); Associate Director for Projects, Divisions of Reactor Projects (NRR/DRPE & DRPW); and the regions.

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ACTION PLAN TO IMPROVE CORE PERFORMANCE

1. Background

Economic pressures on licensees have led to increased competition among vendors providing fuel and reload analysis, resulting in reactor cores with mixed reload designs from multiple vendors of both core components and fuel services. A reduction in NRC direct review and oversight of core reload activities has also occurred, without a corresponding increase in NRC inspection activities. The applicable regulatory requirements are primarily 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," and Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." Table 7, "Regulatory Basis for Fuel/Core Design Criteria," gives a summary listing of licensee requirements and guidelines that are used by licensees and provide the inspection basis.

At the present time, the following vendors supply nuclear fuel, core reload analyses, and other fuel-services to NRC licensees:

(a) ABB Combustion Engineering (ABB/CE):

- Hematite, Missouri - uranium hexafluoride (UF_6) conversion facility
- Windsor, Connecticut - neutronics engineering, PWR fuel manufacturing
- Vasteras, Sweden - BWR fuel manufacturing

(b) Babcock and Wilcox Company (B&W):

- Lynchburg, Virginia - neutronics engineering, PWR fuel manufacturing

(c) General Electric Company (GE):

- San Jose, California - neutronics engineering
- Wilmington, North Carolina - UF_6 conversion facility, tube and BWR fuel manufacturing

(d) Siemens Power Corporation - Nuclear Division (SPC-ND):

- Richland, Washington - UF_6 conversion facility, neutronics engineering, BWR and PWR fuel manufacturing
- Lingen, Germany - component manufacturing

(e) Westinghouse Electric Corporation (W):

- Monroeville, Pennsylvania - neutronics engineering
- Blairsville, Pennsylvania - tube manufacturing
- Columbia, South Carolina - UF_6 conversion facility, PWR fuel manufacturing

2. Core Performance Issues

A primary issue is the increased complexity of core reloads because of mixed core designs, resulting from licensee/vendor optimization activities to enhance performance and to take advantage of available operating margins, while reducing fuel and operating costs. An economic incentive exists for both vendors and licensees to develop methods and reload designs that reduce thermal margin to gain operating flexibility. The staff's primary concern is that these activities be conducted with a sound technical approach that maintains an acceptable level of safety. Core performance problems also include control rod material failures, degraded scram timing, stuck control rods, extended fuel cycle effects, including moderator temperature coefficient (MTC), and high burnup fuel issues. Increased fuel failures are now being observed and several recent fuel and control rod design and fabrication problems at vendor facilities have not been caught by existing quality assurance procedures.

Core design is a fundamental component of plant safety because maintaining fuel integrity is the first principal safety barrier (i.e., fuel cladding, reactor coolant system boundary, or the containment) against serious radioactive releases. Likewise, the safety analyses must be properly performed in order to verify, in conjunction with startup tests and normal plant parameter monitoring, that the core reload design is adequate. Quality assurance activities are important to ensure that proper interfaces are established and that shortcuts are not taken that could degrade safety or quality.

3. Causal Factors

Preliminary evaluation of the root causes of core performance problems points to inadequate analysis and testing of new core designs, as well as vendor manufacturing problems. Less-than-adequate licensee oversight and weaknesses in the vendor-licensee interface execution are additional contributing factors. The operating service experience of core components is also approaching the materials and fuel burnup limits which are supported by available operational and experimental data. Recently available foreign data, currently under evaluation, indicate that the capability of high burnup fuel to withstand moderate power transients may be less than previously assumed.

4. Current Staff and Inspection Activities

SRXB and VIB staffs participate in augmented inspection teams (AITs) and vendor inspections (primarily reactive responses), and SRXB staff evaluates licensee topical reports concerning reload design methods and application. The staff issues generic communications regarding fuel and core operating problems. Scheduled meetings with vendors are used as a forum to discuss core component operating performance and surveillance activities. VIB also represents the NRC at and regularly attends semi-annual meetings of the Nuclear Fuel User's Forum. The current fuel performance annual reports, based on available licensee event reports (LERs) and annual vendor reports, provide descriptions and evaluations of specific fuel operating experience and generic trends.

VIB has led periodic reactive inspections of nuclear fuel vendors, and both VIB and SRXB have participated in the AIT activities at 4. B. Robinson and SPC-ND. A vendor inspection, led by VIB and supported by SRXB, at the SPC-ND facility in Richland, Washington, was recently completed. This inspection is the first of the planned Task 1 inspections of nuclear fuel vendor's facilities and serves as a model for future performance-based inspections.

SRXB, with contracted technical assistant (TA) support, performed a technical audit of the GE-11 fuel design licensing qualification and compliance with Amendment 22 of the approved GESTAR-II topical report at GE's engineering facility in San Jose, California. This audit provides a format and procedure for inspecting vendor compliance within the limitations of their approved methods. SRXB, the project manager, and a representative from the region performed a technical audit of licensee application of approved vendor methods at Arizona Public Service (the Palo Verde licensee), to review the adequacy of its methods and procedures for performing core reload analysis for the Palo Verde plants. This audit provides a basis for future licensee/plant performance-based inspections.

5. Proposed Action Plan

The proposed action plan consists of a planned, coordinated, and systematic program to improve core performance by implementing the following four interrelated task actions:

- Task 1 - Inspections of Nuclear Fuel Vendors
- Task 2 - Inspections of Licensee's Reload Analysis
- Task 3 - Core Performance Data Gathering and Evaluation
- Task 4 - Regional Participation in the Action Plan To Improve Core Performance

The proposed action plan requires close interaction and coordination between VIB and SRXB to effectively implement the planned integration of the inspections of vendors and licensees/plants, gathering of core performance data, and regional training. Taken together, these task actions address the concerns described in Section 2 above and form the basis of the FY 95 pilot program which will be formalized in Inspection Manual Chapters (IMCs) for future application. The nuclear fuel vendor and licensee/plant performance-based inspections will be conducted on the basis of draft IMCs for each inspection type (nuclear fuel vendors and licensee/plants). Lessons learned from the inspections will be used to finalize the IMCs at the completion of the planned FY 95 activities.

As an example of the planned integration of the task actions, the results of Task 1 will provide background information, developed by conducting performance-based inspections of the vendors, for use during the licensee/plant reload analysis reviews addressed in Task 2. Tasks 1 and 2 inspections will also include inspections of the licensee-vendor responsibility interface.

The results of these inspections will be provided to licensees and vendors by way of issued inspection reports. Licensee performance will also be reflected in the systematic assessment of licensee performance (SALP) process and regional enforcement actions. Generic communications have proven to be an effective method of providing feedback to licensees and vendors and will be issued, as necessary.

**Total Resource Estimates To Implement the Action Plan To
Improve Core Performance for the Planned FY 95 Activities:**

Task	TA Support \$		Staff Hrs.	
	VIB	SRXB	VIB	SRXB
Task 1 - Inspections of Nuclear Fuel Vendors	220K	28K	2120	630
Task 2 - Inspections of Licensee's Reload Analysis	-	88K	600	1440
Task 3 - Core Performance Data Gathering and Evaluation	5K	361K	334	506
Task 4 - Regional Participation in the Action Plan To Improve Core Performance	-	15K	280	440
Totals	225K	492K	3334	3016

(a) Task 1 - Inspections of Nuclear Fuel Vendors

This task consists of evaluating the performance of vendors of nuclear fuel and core components by, in part, including in the inspection scope neutronics engineering, fuel fabrication, fuel bundle assembly, and related fuel-service activities. The detailed schedule milestones and resource estimates for this task are shown in Table 1, "Task 1 - Inspections of Nuclear Fuel Vendors: Schedule Milestones and Resource Estimates for FY 95 Activities." The results of this task will provide input for the inspection of licensee/plant reload analysis, addressed in Task 2 below, and additional input data on core performance for the Task 3 evaluation.

For the Task 1 inspections listed in Table 5, "Preliminary Schedule for the Inspections of Nuclear Fuel Vendors and Licensee's Reload Analysis," VIB plans to lead an inspection team consisting of two members from VIB, one member from SRXB, and up to three contracted TAs per facility inspected. Table 5, shows the proposed FY 95 schedule for the Task 1

inspections of fuel vendors and core component manufacturers and the Task 2 inspections of licensee reload analysis. The inspection goals are to conduct an inspection of each fuel vendor once every 12 to 18 months and conduct, on an annual basis, an inspection of one licensee's reload analysis per region.

Each inspection will require 2-3 days of inspection preparation at the vendor's facility by the team leader and a VIB member, 2-3 days of inspection preparation at headquarters by the full team, and one full week of inspection effort per vendor's facility by the full team.

(b) Task 2 - Inspections of Licensee's Reload Analysis

This task consists of evaluating the performance of licensees that perform core reload analysis functions. The detailed schedule milestones and resource estimates for this task are shown in Table 2, "Task 2 - Inspections of Licensee's Reload Analysis: Schedule Milestones and Resource Estimates for FY 95 Activities." The results of this task provide input for the inspection of nuclear fuel vendors, addressed in Task 1 above, and additional input data on core performance for the Task 3 evaluation.

As part of this task, SRXB will lead the first inspection in each region and subsequently assist region-led inspections, selected from Table 6, "Licensee/Plant Core Design and Reload Analysis Responsibilities and Status," as requested. To determine the initial licensee/plant inspection priorities for the first inspection in each region, SRXB will select the licensee/plant from Table 6, which will describe, with input from the regions, the licensee-vendor core design and reload analysis responsibilities and interfaces.

SRXB will evaluate the licensees identified in Table 6 for priority ranking on the basis of previous reload review experience, with input provided by the regions and project managers. Documentation of core reload analysis/licensing procedures for individual licensees will identify candidates for inspection and help prioritize the inspection schedule. Table 6 will describe, with input from the regions, the licensee-vendor core design and reload analysis responsibilities and interfaces. The licensee rankings are based on preliminary criteria, which will be further developed and refined on the basis of the results from Task 2. The criteria for the preliminary rankings include such factors as mixed core reload designs, mixed vendor core components, licensee reload design responsibility, core component reliability history, and plant operational problems.

The inspection schedule and resources requirements for these inspections will be coordinated with the regions for effective implementation. Each SRXB-led inspection will consist of a member from SRXB, a member from VIB, members from the region, and one TA. Each inspection will require

2-3 days of preparation at the licensee's facility by SRXB and a regional member, 2-3 days of preparation at headquarters by the full team, and one full week of inspection effort at the licensee facilities by the full team.

(c) **Task 3 - Core Performance Data Gathering and Evaluation**

Task 3 consists of the identification, documentation, and categorization of core performance problems and root cause evaluations that will be further evaluated during the inspections conducted in Tasks 1 and 2, and the provision of input to SALP evaluations, regional enforcement actions, and generic communications, as appropriate. The detailed schedule milestones and resource estimates for this task are shown in Table 3, "Task 3 - Core Performance Data Gathering and Evaluation: Schedule Milestones and Resource Estimates for FY 95 Activities." The information gathered will be correlated with periodic analysis of generic fuel performance problems and evaluated regarding the need for information notice updates. An enhanced core performance annual report (i.e., the data gathered during this task action will support the development of NUREG/CR-3950, "Fuel Performance Annual Report") will further evaluate core performance data and identify emerging trends based on the independent data acquisition and analysis resulting from this action plan.

This task is also intended to enhance staff analyses of extended burnup cycle issues by supporting planned research activities in analyzing available experimental data. The regional staff will be consulted in the development of plans and procedures for better tracking and documentation of core performance experience. Task 3 also will provide input for the final IMCs.

(d) **Task 4 - Regional Participation in the Action Plan To Improve Core Performance**

Task 4 consists of training and coordinating the regional support staff participating in both Tasks 2 and 3 activities. The detailed schedule milestones and resource estimates for this task are shown in Table 4, "Task 4 - Regional Participation in the Action Plan To Improve Core Performance: Schedule Milestones and Resource Estimates for FY 95 Activities." This task provides for the necessary training of regional staff to properly identify and provide feedback on fuel performance issues.

This task also includes solicitation of regional support for the Task 2 licensee/plant inspections and for the Task 3 data gathering and evaluation activity and evaluation of the results of these activities as input for the final IMCs.

Table 1

**Task 1 - Inspections of Nuclear Fuel Vendors:
Schedule Milestones and Resource Estimates for FY 95 Activities**

Milestones	TA Support \$		Staff Hrs.		Comple- tion Date
	VIB	SRXB	VIB	SRXB	
1. Develop generic inspection plan	-	-	80	-	8/94
2. Review and provide input to inspection plan	-	-	-	30	8/94
3. Define vendor-specific issues, conduct pre-inspection visits to vendor, and finalize vendor-specific inspection plan					
ABB/CE	-	2K	60	20	9/94
W	-	2K	60	20	11/94
B&W	-	2K	60	20	3/95
GE	-	2K	60	20	7/95
4. Conduct vendor inspections at each applicable vendor facility, document inspection findings, and issue enforcement actions					
ABB/CE - 2 facilities	40K	-	400	80	11/94
W - 3 facilities	60K	-	480	80	3/95
B&W - 1 facility	30K	-	320	80	7/95
GE - 1 facility	30K	-	320	80	11/95
5. VIB/SRXB evaluate vendor's responses to cited violations, nonconformances, and open items, and conduct followup activities as necessary					
ABB/CE	15K	5K	60	40	
W	15K	5K	60	40	
B&W	15K	5K	60	40	
GE	15K	5K	60	40	
6. Draft IMC for the inspections of nuclear fuel vendors	-	-	120	40	11/95
Totals	220K	28K	2120	630	

Table 2

**Task 2 - Inspections of Licensee's Reload Analysis:
Schedule Milestones and Resource Estimates for FY 95 Activities**

Milestones	TA Support \$		Staff Hrs.		Comple- tion Date
	VIB	SRXB	VIB	SRXB	
1. Develop generic inspection plan, criteria, and draft IMC	-	-	-	120	10/94
2. Review and provide input to inspection plan.	-	-	20	-	11/94
3. Define plant-specific issues, conduct pre-inspection visits to plant, and finalize plant-specific inspection plan					
RIII Licensee/Plant A	-	2K	20	120	11/94
RII Licensee/Plant B	-	2K	20	120	12/94
RI Licensee/Plant C	-	2K	20	120	2/95
RIV Licensee/Plant D	-	2K	20	120	4/95
4. Conduct plant inspections, document inspection findings, and draft proposed enforcement actions					
RIII Licensee/Plant A	-	15K	80	60	12/94
RII Licensee/Plant B	-	15K	80	60	3/95
RI Licensee/Plant C	-	15K	80	60	6/95
RIV Licensee/Plant D	-	15K	80	60	9/95
5. SRXB/VIB evaluate licensee's responses to cited violations, nonconformances, and open items, and conduct followup activities as necessary					
RIII Licensee/Plant A	-	5K	40	120	
RII Licensee/Plant B	-	5K	40	120	
RI Licensee/Plant C	-	5K	40	120	
RIV Licensee/Plant D	-	5K	40	120	
6. Finalize IMC for the inspections of licensees/plants.	-	-	20	120	11/95
Totals	-	88K	600	1440-	

Table 3

Task 3 - Core Performance Data Gathering and Evaluation:
Schedule Milestones and Resource Estimates for FY 95 Activities

Milestones	TA Support \$		Staff Hrs.		Completion Date
	VIB	SRXB	VIB	SRXB	
1. Develop core performance data gathering plan	-	-	20	100	8/94
2. Conduct meetings with nuclear fuel vendors and international dialogue on fuel performance issues					
ABB/CE	-	2K	18	18	10/94
W	-	2K	18	18	12/94
B&W	-	2K	18	18	2/95
GE	-	2K	18	18	4/95
SPC-ND	-	2K	18	18	6/95
International Contacts	-	10K	40	40	9/95
Nuclear Fuel User's Forum	-	-	64	-	12/94 & 6/95
3. Support Department of Energy Lab research work					
• BNL - Extended RIA cycle/positive moderator temperature coefficient	-	120K	-	12	10/95
• PNL - High burnup fuel, UNL	-	RES	-	12	4/95
• INEL - High burnup fuel, UNL	-	RES	-	12	7/95
4. Evaluate the results from Tasks 2 & 3 for generic implications	-	6K	40	120	9/95
5. Review, revise, and enhance the core performance reports					
• 1992 & 1993 Core Performance Reports	-	140K	20	60	3/95
• 1994 Core Performance Report	-	75K	20	40	9/95
6. Finalize IMC for the inspections of nuclear fuel vendors.	5K	-	40	20	9/95
Totals:	5K	361K	334	506	

Table 4

Task 4 - Regional Participation in the Action Plan
To Improve Core Performance:
Schedule Milestones and Resource Estimates for FY 95 Activities

Milestones	TA Support \$		Staff Hrs.		Comple- tion Date
	VIB	SRXB	VIB	SRXB	
1. Conduct meetings with participants from each region on proposed inspection plans for inspections of licensee/plants	-	-	80	80	
2. Review inspection results from Tasks 1 and 2 with participants from each region	-	-	20	20	
3. With input from the regions, define plant-specific issues, conduct pre-inspection visits to plant, and finalize plant-specific inspection plan:					
RIII Licensee/Plant A	-	2K	20	50	9/94
RII Licensee/Plant B	-	2K	20	50	10/94
RI Licensee/Plant C	-	2K	20	50	11/94
RIV Licensee/Plant D	-	2K	20	50	12/94
4. Conduct training of regional participants	-	2K	80	80	12/94
5. Perform licensees/Plants inspections (see Table 2)					
6. With input from the regions, finalize IMCs	-	5K	20	60	9/95
Totals:	-	15K	280	440	

Table 5

Preliminary Schedule for the Inspections of Nuclear Fuel Vendors and Licensee Reload Analysis

Fiscal Year/ Nuclear Fuel Vendors	1994 J F M A M J J A S O N D	1995 J F M A M J J A S O N D	1996 J F M A M J J A S O N D
ABB/CE			
B&W			
GE			
SPC-ND			
W			
Licensee Reload Analysis Per Region	1994 J F M A M J J A S O N D	1995 J F M A M J J A S O N D	1996 J F M A M J J A S O N D
Region I			
Region II			
Region III			
Region IV			

Licensees/Plants: (A) through (I) to be determined by Tasks 1, 2, and 3

Table 6

Licensee/Plant Core Design and Reload Analysis Responsibilities and Status

Licensee (Utility) Plant	NSSS Vendor	OL Date	Fuel Vendor	Reload Analysis	Methodologies/Codes/Models		Core Performance Status	Region /Grp.	Insp. Rank
					Steady State	Transient			
Southern Nuclear Operating Co. (SNOC):									
• Joseph M. Farley 1	W	06/25/77	W	W/SNOC	EPRI	EPRI; LOCA - W	W 17x17 LOPAR, OFA & VANTAGE-5 w/FBA	II/1	
• Joseph M. Farley 2		03/31/81	W	W/SNOC			W 17x17		
Arizona Public Service Co. (APS):									
• Palo Verde 1	CE	06/01/85	CE	APS				IV/2	
• Palo Verde 2		04/24/86	CE	APS					
• Palo Verde 3		11/25/87	CE	APS					
Cleveland Electric Illuminating Co. (CEI):									
• Perry 1	GE 6	11/13/85	GE	GE/CEI	EPRI	EPRI; LOCA - GE	GE 9x9 BARNER	III/	

Table 7

Regulatory Basis for Fuel/Core Design Criteria

- 10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 10, "Reactor Design," and GDC 12, "Suppression of Reactor Power Oscillations"
- 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants And Fuel Reprocessing Plants"
- Licensee/Plant Updated Final Safety Analysis Report (UFSAR), Chapter 4.2, "Fuel System Design Requirements"
- Licensee/Plant Technical Specifications, Chapter 3.12, "Core Thermal Limits"
- Nuclear Fuel Vendor's Quality Assurance and Technical Topicals approved by the NRC
- NUREG-0800, "Standard Review Plan," Section 4.2, "Fuel System Design," and Appendix A, "Evaluation of Fuel Assembly Structural Response to Externally Applied Forces"
- NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission"
- Generic Letter (GL) 83-11, "Licensee Qualification for Performing Safety Analysis in Support of Licensing Actions"
- GL 88-16, "Removal of Cycle-Specific Parameter Limits From Technical Specifications (COLR)"
- GL 90-02, Supplement 1, "Alternative Requirements for Fuel Assemblies in the Design Features Section of Technical Specifications"
- SECY-92-263, "Staff Plans for Elimination of Requirements Marginal to Safety"