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SUBJECT: Application for amends to Licenses NPF-41,NPF-51 & NPF-74, proposing TS Sections 5.3.1 & 5.6.1 & new TS Section 3/4.9.13 & Bases 3/4.9.13 re boron concentration-storage pool.

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10 CFR 50.90

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WILLIAM F. CONWAY
EXECUTIVE VICE PRESIDENT
NUCLEAR

102-02838-WFC/RAB/GEC
February 18, 1994

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Proposed Amendment to Technical Specification Sections 5.3.1 and 5.6.1, and New Technical Specification Section 3/4.9.13 and BASES 3/4.9.13
File: 94-005-419.05

Pursuant to 10 CFR 50.90, Arizona Public Service Company (APS) submits herewith a proposed amendment to existing Technical Specifications 5.3.1, Fuel Assemblies, and 5.6.1, Criticality; and a proposed new Technical Specification 3/4.9.13, Boron Concentration-Storage Pool, and associated BASES 3/4.9.13, Boron Concentration-Storage Pool. This proposed amendment is requested to allow credit to be taken for burnup of spent fuel assemblies in establishing storage locations within the PVNGS spent fuel pools beginning with PVNGS Unit 2, Refueling 5.

The Plant Review Board and Offsite Safety Review Committee have reviewed and approved the proposed amendment. Pursuant to 10 CFR 50.91(b)(1), a notification of this request, including the no significant hazards consideration determination, is being provided to the Arizona Radiation Regulatory Agency (ARRA) by copy of this letter.

Provided in the enclosure to this letter are the following:

A. Description of the Proposed Amendment
B. Purpose of the Technical Specification
C. Need for the Technical Specification Amendment
D. Safety Analysis of the Proposed Technical Specification Amendment

A001

E. No Significant Hazards Consideration Determination
F. Environmental Impact Consideration Determination
G. Marked-up Technical Specification Pages

Should you have any questions, please contact Richard A. Bernier at (602) 393-5882.

Sincerely,

WFC/RAB/GEC/bcf

Enclosure

cc: K. E. Perkins, Jr.
K. E. Johnston
B. E. Holian
A. V. Godwin (ARRA)

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, W. F. Conway, represent that I am Executive Vice President - Nuclear, that the foregoing document has been signed by me on behalf of Arizona Public Service Company with full authority to do so, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true and correct.

W. F. Conway

Sworn To Before Me This 18 Day Of February 1994.

Linda B. Spell
Notary Public

My Commission Expires

March 31, 1996

ENCLOSURE

PROPOSED AMENDMENT TO TECHNICAL SPECIFICATION

SECTIONS 5.3.1 AND 5.6.1, AND NEW TECHNICAL SPECIFICATION

SECTION 3/4.9.13 AND BASES 3/4.9.13

A. DESCRIPTION OF THE PROPOSED AMENDMENT

The Palo Verde Nuclear Generating Station (PVNGS) spent fuel storage pool is presently configured to store new fuel assemblies, with a maximum radially averaged enrichment equal to 4.30 weight percent U-235, and spent fuel assemblies in a checkerboard configuration. The proposed amendment will, by an analysis that credits assembly burnup (the analysis is discussed in section D), change the spent fuel storage pool configuration to a three region pool where spent fuel can be stored in a two-out-of-four, three-out-of-four, or a four-out-of-four array, dependent upon the initial assembly enrichment and the assembly burnup. The three regions will be administratively established and will be physically configured by removing specific cell blocking devices.

The proposed configuration for the PVNGS spent fuel storage pool will include three distinct storage regions. Region 1 will store fresh fuel assemblies with a maximum radially averaged enrichment equal to 4.30 weight percent U-235 in a checkerboard configuration. Region 2 will store spent fuel assemblies predominately in a three-out-of-four configuration. Region 3 will store spent fuel assemblies in a four-out-of-four configuration. The primary results of this analysis are the required assembly burnup versus initial assembly enrichment curves for safe storage in Regions 2 and 3.

Figure 1 identifies the proposed three region configuration for the PVNGS spent fuel storage pool. Region 1 is comprised of three 9X8 storage racks, one 12X8 storage rack, and one 9X9 storage rack with cell blocking devices already in place in every other storage rack location. Region 2 is comprised of three 9X8 storage racks and one 12X8 storage rack. Cell blocking devices are primarily employed in Region 2 in one out of every four storage rack locations. Additional cell blocking devices are employed in Region 2 along the interface with Region 3, in every other storage rack location, to eliminate the possibility of having an unanalyzed arrangement of assemblies. Figure 1 identifies the required cell blocking device configuration for Region 2. Region 3 is comprised of six 9X8 storage racks and two 12X8 storage racks, and employs no cell blocking devices.

The PVNGS spent fuel storage pool design currently incorporates "L" inserts, as shown in UFSAR Figure 9.1-6 (attached), in two-out-of-four storage rack locations (the "L" inserts are installed in those locations not presently containing cell blocking devices as shown in UFSAR Figure 9.1-5, attached). As part of the plan for increasing available storage in the spent fuel storage pool, APS will not install "L" inserts in the cells where "L" inserts are not presently installed. The safety analysis described in Section D, below, accounts for the "L" inserts presently not installed. In addition, a seismic analysis was performed which concluded that fuel rack stresses, embedment loads, and storage rack mounting pad stresses are

acceptable for all the new arrangements, and that effects on the fuel element are enveloped by the previous analysis.

Arizona Public Service Company (APS) proposes to modify Technical Specification 5.6.1, "Criticality," by (1) clarifying the uncertainties margin; (2) establishing a nominal 9.5 inch center-to-center distance between adjacent storage cell locations, rather than the present 9.5 inch center-to-center distance between fuel assemblies placed in the storage racks in a high density configuration; (3) defining the three regions of the spent fuel storage pool; and (4) incorporating Figure 5.6-1 that establishes the parameters for storing fuel in each of the three spent fuel storage pool regions.

APS proposes to delete, in Technical Specification 5.3.1, "Fuel Assemblies", the footnote requiring that "No fuel with an enrichment greater than 4.0 weight percent U-235 shall be stored in a high density mode in the spent fuel storage facility.". Crediting assembly burnup will allow a change to the spent fuel pool configuration to a three region pool dependent upon the initial assembly enrichment (up to 4.30 weight percent) and the associated assembly burnup.

APS proposes to add a new Technical Specification 3/4.9.13, "Boron Concentration - Spent Fuel Storage Pool," and BASES 3/4.9.13, "Boron Concentration - Spent Fuel Storage Pool," that establishes a minimum soluble boron concentration in the spent fuel storage pool of 2150 parts per million (ppm) of soluble boron whenever fuel assemblies are in the spent fuel storage pool.

APS proposes to modify the Technical Specification INDEX to reflect changes resulting from this proposed amendment and to include Figures 3.4-2c and 3.4-2d that were inadvertently omitted in Unit 1 Amendment 62 and Unit 2 Amendment 55.

The proposed change is acceptable since:

a. The Palo Verde fuel handling equipment and storage areas have been analyzed and demonstrated to meet appropriate acceptance criteria for a maximum radially-averaged enrichment of any axial enrichment zone within a fuel assembly of 4.30 weight percent U-235.

b. Analysis has been performed to demonstrate that when spent fuel of specific initial enrichments and specific assembly burnups are stored in either a three-out-of-four or a four-out-of-four array, the k_{eff} will not exceed 0.95 with a 95% probability at a 95% confidence level when the fuel pool is flooded with unborated water.

c. Analysis has been performed to demonstrate that in the worst condition of a misloading event when a new fuel assembly with a maximum radially-

averaged enrichment of any axial enrichment zone within the fuel assembly of 4.30 weight percent U-235 is placed in a three-out-of-four or a four-out-of-four array, or dropped in the gap between the pool wall and a Region 3 storage rack, the k_{eff} will not exceed 0.95 when the fuel pool is flooded with borated water with a boron concentration of at least 2150 ppm.

B. PURPOSE OF THE TECHNICAL SPECIFICATION

The following design bases are imposed on the storage of fuel within the spent fuel storage pool (reference UFSAR section 9.1.2.1):

a. Accidental criticality shall be prevented for the most reactive arrangement of fuel stored with optimum moderation by avoiding a k_{eff} greater than 0.95. This design basis shall be met under any normal or accident conditions.

b. The requirements of Regulatory Guide 1.13 (Revision 0, March 10, 1971) shall be met.

c. The storage racks and facilities shall be Seismic Category I.

d. Storage shall be provided for up to 1329 fuel assemblies.

e. The storage racks and spent fuel storage pool facilities shall prevent extensive bulk boiling in the storage racks and prevent fuel assembly peak clad temperatures from exceeding 650°F.

f. Shielding of spent fuel shall be adequate to ensure that the radiation zone criteria of (UFSAR) section 12.3 are met.

C. NEED FOR THE TECHNICAL SPECIFICATION AMENDMENT

The current spent fuel storage pool configuration will not provide adequate storage space to store all discharged spent fuel in the checkerboard storage pattern beginning with Unit 2 Refueling 5 (currently scheduled to occur in Spring of 1995). Establishing a series of regions, based upon burnup, will allow PVNGS to continue to utilize the existing spent fuel storage pool in each unit for several more refueling cycles without installing neutron poison inserts as currently described in the UFSAR. The amendment is needed prior to the beginning of the refueling outage to allow adequate time for reconfiguration of the pool and redistribution of the currently stored spent fuel assemblies in the new three-region storage arrangement.

D. SAFETY ANALYSIS OF THE PROPOSED TECHNICAL SPECIFICATION AMENDMENT

The following description of the criticality analyses support the safe storage of fresh fuel assemblies having a maximum radially averaged enrichment of 4.30 weight percent U-235. The original analysis performed for the Palo Verde spent fuel storage pool with high density storage configuration supported a maximum enrichment limit of 4.0 weight percent U-235. The checkerboard storage configuration discussed in section 9 of the UFSAR was actually analyzed with a maximum uniform enrichment of 4.30 weight percent U-235.

1. Design Bases

The following standards, codes, and regulations form the bases for the criticality safety of spent fuel storage pools:

ANSI/ANS-57.2-1983, "Design Requirements for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Plants", Section 6.4.2, General Design Criterion 62, "Prevention of Criticality in Fuel Storage and Handling"

NUREG-0800, USNRC Standard Review Plan, Section 9.1.2, "Spent Fuel Storage"

These regulations and guides require that:

For spent fuel storage racks, the maximum calculated k_{eff} value, including margin for uncertainty in calculational method and mechanical tolerances, be less than or equal to 0.95 with a 95% probability at a 95% confidence level when flooded with unborated water.

2. Criticality Safety Methodology

In order to accurately predict the multiplication factor of the storage arrays, reliable calculation of the spatial flux distribution, especially in the neutron absorbing regions, is essential. For this reason, a two dimensional transport calculational model of the spent fuel storage racks is employed in which each component of the fuel storage array is explicitly represented. Thus in the normal spent fuel storage cell calculation, the fuel assembly, and the water channel between the neutron poison insert and the wall are represented as separate regions.

The fuel assembly is represented as a 16X16 array of fuel pin cells containing moderator and either fuel pins, guide tubes, or instrument tubes. Four neutron energy group cross-sections are generated for each fuel

assembly cell and for each component of the storage cell with special attention given to the effect of adjoining regions on the spatial thermal spectrum and hence broad group thermal cross-sections of each separate region of the storage cell.

2.1 Cross Section Generation

The CEPAK lattice program is used to calculate four neutron energy group cross sections for the fuel, water, and steel regions. This program is the synthesis of a number of codes, (e.g., FORM, THERMOS, and CINDER). These programs are interlinked in a consistent manner with an extensive library of differential neutron cross section data. The data base for both fast and thermal neutron cross sections for this version of the CEPAK program is derived from several sources, mainly ENDF/B-IV. This data base gives good agreement with measured data from critical experiments and operating reactors.

Since CEPAK is a lattice cell code, the input geometric buckling must be indicative of the neutronic environment of the fuel assembly in the storage rack. The geometric buckling supplied to CEPAK is derived from the DOT X-Y transport solution for a fuel assembly in the storage rack environment.

The group dependent poison cross sections, if poison inserts are present in the array, are generated by a 123 group, P-3, S-8 XSDRNPM calculation. The resulting set of four-group cross sections are a function of the poison density, poison thickness, and surrounding environment.

2.2 Two-Dimensional Generations

The two-dimensional, discrete ordinates transport code DOT-IV was used to determine the spatial solution and multiplication factor. An S-6 order of angular quadrature is used with a 1.0005 convergence factor (the ratio of successive eigenvalues for each outer integration). In the storage cell calculations, an assembly is represented with one mesh interval for each fuel pin cell; The surrounding water channel, steel and water gap regions are calculated with 2 or more mesh intervals.

2.3 Qualification of Analytical Methods

Qualification of the calculational method and evaluation of calculational uncertainties and bias factors are based on the analysis of a variety of critical experiments. Results of this qualification for a total of 41 analyzed experiments indicates that the reactivity is over-predicted by 0.197 percent and has a 95/95 confidence level uncertainty equal to 0.714 percent.

Included in the methodology validation is the analysis of uranium dioxide critical experiments typical of reactor cores, Brookhaven National Laboratory exponential experiments typical of isolated assemblies, and Pacific Northwest Laboratory critical separation experiments with spacings and poison inserts typical of fuel storage racks.

3. Criticality Safety Analysis

3.1 Regions of the Pool

Figure 1 illustrates the proposed three region configuration for the PVNGS spent fuel storage pools. The racks in Region 1 of the pools will be used to store spent fuel assemblies in a two-out-of-four storage configuration. A cell blocking device (shown in USFAR Figure 9.1-6, Sheet 1 of 2, attached) will be used in two of every four storage cell locations. The racks in Region 2 of the pools will be used to store spent fuel assemblies in a three-out-of-four storage configuration. A cell blocking device (shown in USFAR Figure 9.1-6, Sheet 1 of 2, attached) will be used in one of every four storage cell locations (with additional cell blocking devices along the interface with Region 3 to eliminate the possibility of having an unanalyzed arrangement of assemblies). Region 3 will be used to store spent fuel assemblies in a four-out-of-four storage pattern. No cell blocking devices will be employed in Region 3. The current Region 1 pattern of stainless steel "L" inserts, presently installed as shown in UFSAR Figure 9.5-1 (attached) with a nominal thickness equal to 0.175 inches, will also be employed for both Regions 2 and 3.

The modeling of Regions 2 and 3 of the spent fuel storage pool assumed no axial leakage, no poison shims present in the assemblies, no grids, and no soluble boron in 68 degree water. The nominal pitch of fuel cells modeled for the 16X16 assembly is 0.506 inches. The analysis conservatively assumed a pellet diameter of 0.33 inches and a uranium dioxide stack density equal to 10.4 g/cc. Periodic boundary conditions were employed in the DOT calculations to correctly account for the non-reflective arrangement of fuel locations with the steel inserts in both Regions 2 and 3.

DOT calculations, with CEPAK generated cross sections, were performed for Regions 2 and 3 of the spent fuel storage pool to generate k_{eff} values as a function of assembly burnup for varying initial enrichments of U-235. This information was used to construct a curve of Burnup versus Enrichment for both Regions 2 and 3 (Figure 5.6-1) such that all points on the curve produce a k_{eff} value (without uncertainties or biases) of 0.93.

Table 5-1 contains the Assembly Burnup - Initial Enrichment data used to produce Figure 5.6-1. The following uncertainties were then applied:

	Deviation	Delta k_{eff} Units
a)	Minimum center to center pitch	0.00455
b)	Eccentric positioning of assemblies	0.00942
c)	Minimum monolith thickness	0.00184
d)	Temperature variations	0.00442
e)	Minimum L-insert thickness	0.00150
f)	Assembly Enrichment (0.05 w/o U-235)	0.00350
g)	Assembly Burnup (1,000 MWD/T)	0.00809
h)	Methodology Uncertainty	0.00714

The calculation methodology has a bias equal to -0.00197 delta k_{eff} units. The square root of the sum of the uncertainties squared is equal to 0.016266 delta k_{eff} units. Therefore, the final k_{eff} value for the PVNGS spent fuel racks is equal to 0.94426 (0.93000 + 0.016266 - 0.00197). This k_{eff} value is less than the design basis of 0.95.

3.2 Interface Between Regions

The interfaces between regions were designed such that the arrangement of assemblies along any interface is less restrictive than the arrangement of assemblies in the infinite array calculations performed for each of the spent fuel storage pool regions. The additional cell blocking devices in Region 2, along the interface with Region 3, are required to eliminate the possibility of having an unanalyzed arrangement of assemblies.

3.3 Accident Analysis and Misloading Events

Accident situations include: (1) an assembly on top of the storage racks, and (2) an assembly next to the side of the storage rack. In addition, it is possible to postulate the inadvertent misloading of an assembly with a burnup and enrichment combination which violates the storage region requirement or the placement of a fresh fuel assembly into Region 2 or Region 3. However, for such accident and misloading events, the Double

Contingency Principle allows for the crediting of 2150 ppm of soluble boron in the spent fuel storage pool water (of the 4000 to 4400 ppm boron that is required by Technical Specification 3.1.2.5, in MODES 5 and 6 when the spent fuel storage pool is being used as the shutdown borated water source, and by Technical Specification 3.1.2.6, in MODES 1, 2, 3, and 4) whenever fuel assemblies are in the spent fuel storage pool. The reduction in reactivity produced by the soluble boron more than compensates the reactivity addition produced by credible accident or misloading events.

E. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10 CFR 50.92. A proposed amendment to an operating license for a facility involves a no significant hazards consideration if operation of the facility in accordance with a proposed amendment would not: (1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) Involve a significant reduction in a margin of safety. A discussion of these standards as they relate to this amendment request follows:

Standard 1 -- Involve a significant increase in the probability or consequences of an accident previously evaluated.

This amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated. Radiological consequences of the fuel handling accident are not impacted by the formation of new storage regions since the fuel assembly design is unchanged. However, even though the probability of occurrence of a fuel misplacement error has increased slightly, the consequences are markedly reduced by the crediting of 2150 ppm of soluble boron in the spent fuel storage pool. The increase is also not significant because of the types of administrative controls being put into place in Regions 2 and 3. Furthermore, a fuel assembly misplacement error is not considered an accident, as defined in the UFSAR.

Standard 2 -- Create the possibility of a new or different kind of accident from any accident previously evaluated.

This amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated. No changes are being made to the fuel assemblies or the storage racks, and controls will be employed to control the placement of assemblies in Regions 2 and 3. As such, there is no possibility of a new or different kind of accident being

created. The existing design basis covers all possible accident scenarios in the spent fuel storage pool.

Standard 3 -- Involve a significant reduction in a margin of safety.

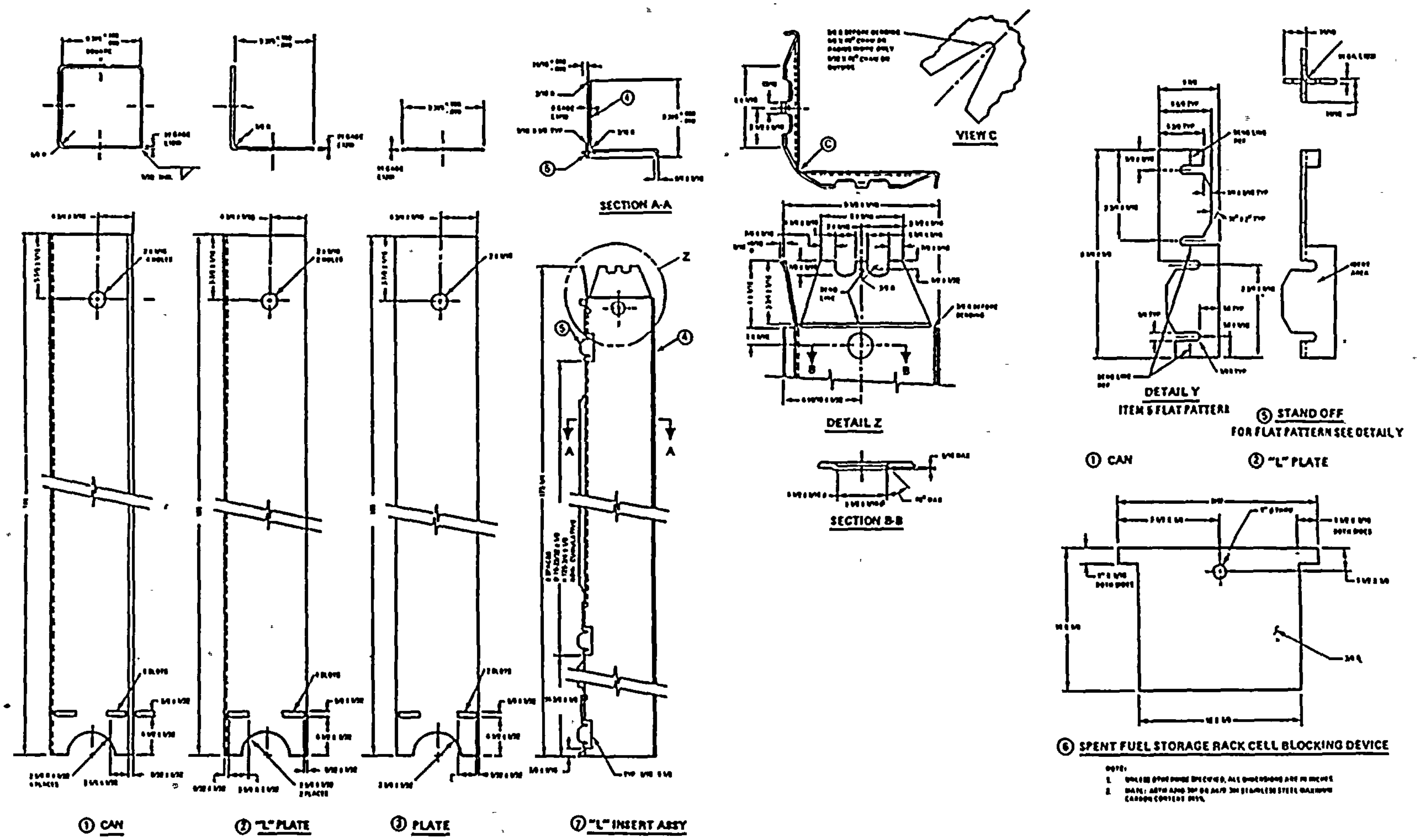
This amendment request will not involve a significant reduction in a margin of safety. There is no reduction in the margin of safety since a k_{eff} less than or equal to 0.95 is met under all analyzed conditions using conservative assumptions which do not credit the soluble boron in the spent fuel storage pool except under some accident conditions, as allowed by NRC guidelines. The original mechanical analyses are unchanged for thermal and seismic/structural considerations, as these analyses were originally performed for a fully loaded spent fuel storage pool.

F. ENVIRONMENTAL IMPACT CONSIDERATION DETERMINATION

APS has determined that the proposed amendment involves no change in the amount or type of effluent that may be released offsite, and that there is no increase in individual or cumulative occupational radiation exposure. As such, operation of PVNGS Units 1, 2, and 3, in accordance with the proposed amendments, does not involve an unreviewed environmental safety question.

G. MARKED-UP TECHNICAL SPECIFICATION PAGES

Units 1, 2, and 3 pages IX, XIV, XIX, 3/4 9-17, B 3/4 9-3, 5-5, 5-6, and 5-6a.



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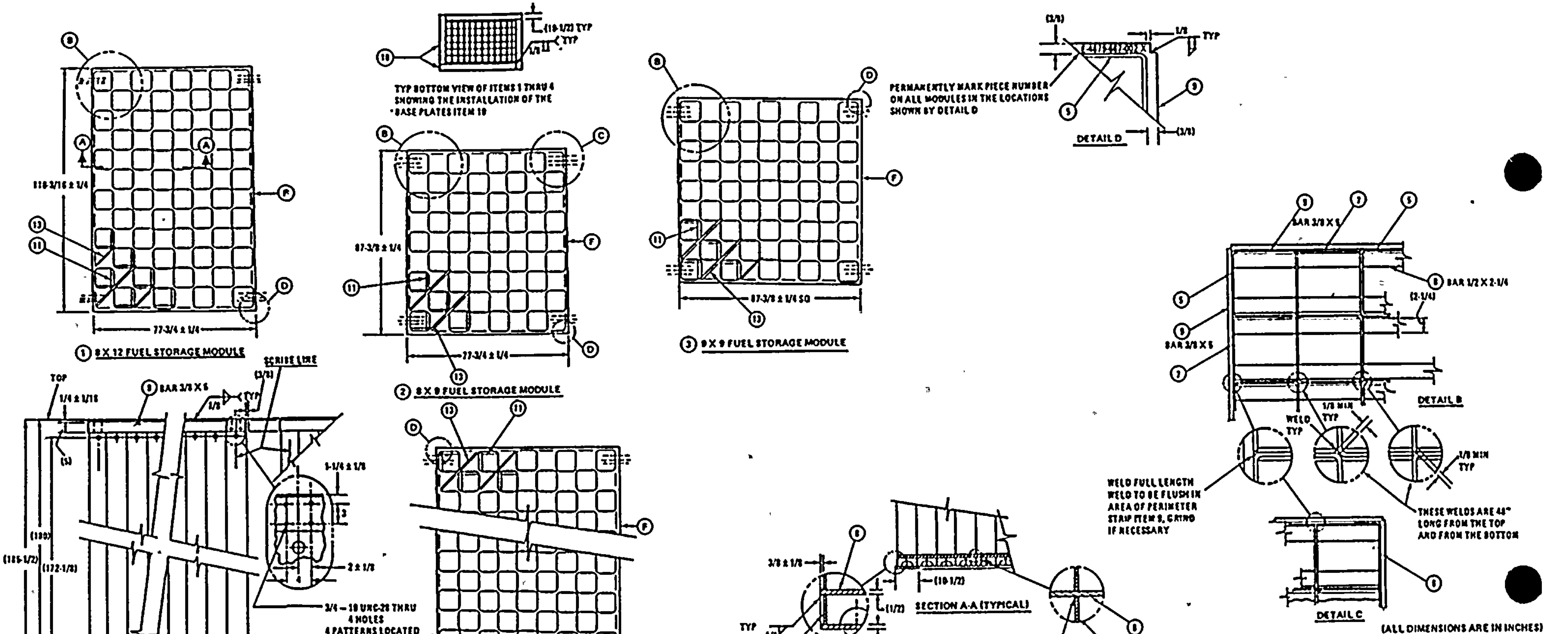
Palo Verde Nuclear Generating Station
Updated FSAR

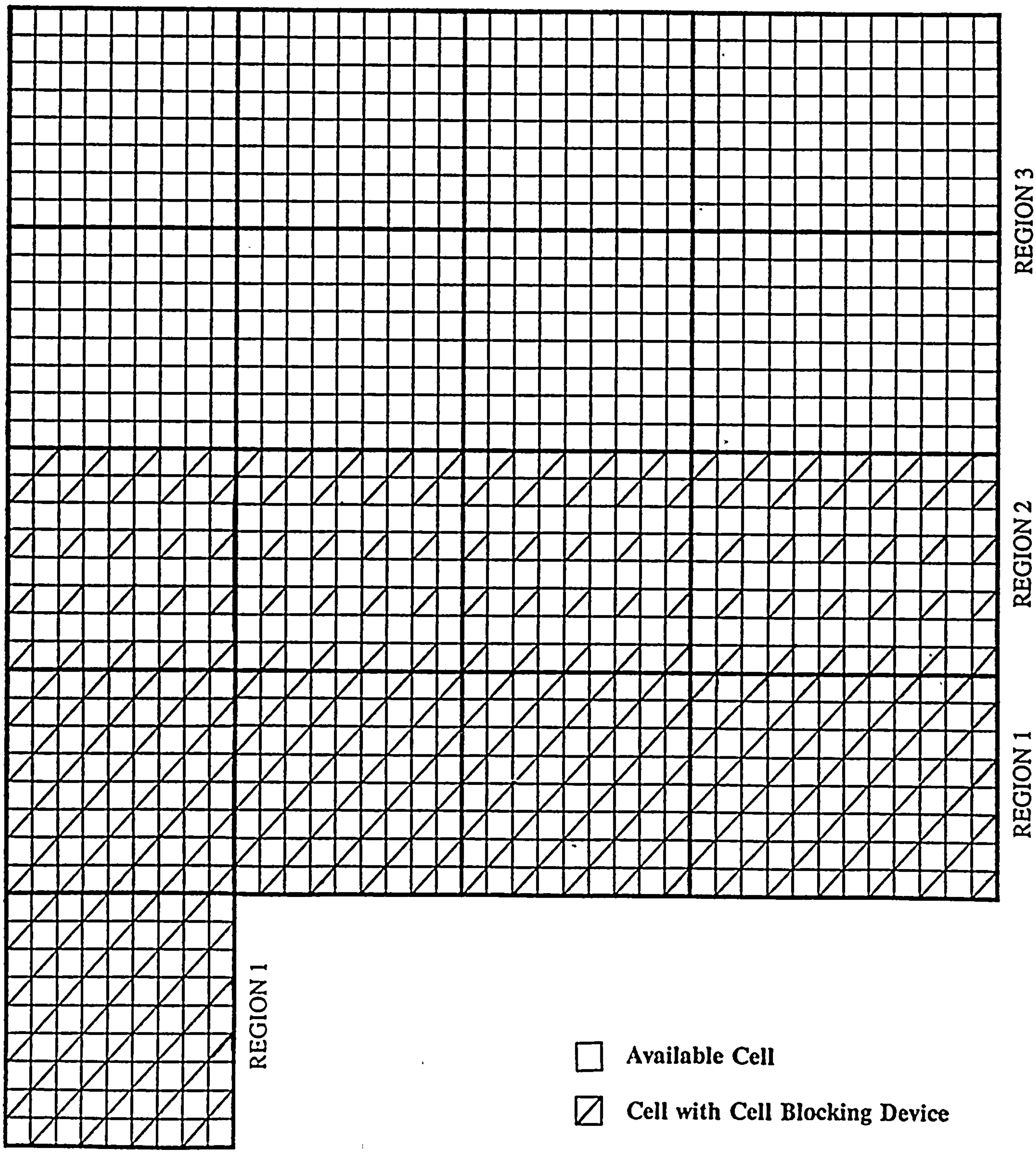
FUEL STORAGE RACK
MODULE ASSEMBLY DETAILS
(Sheet 1 OF 2)
Figure 9.1-6



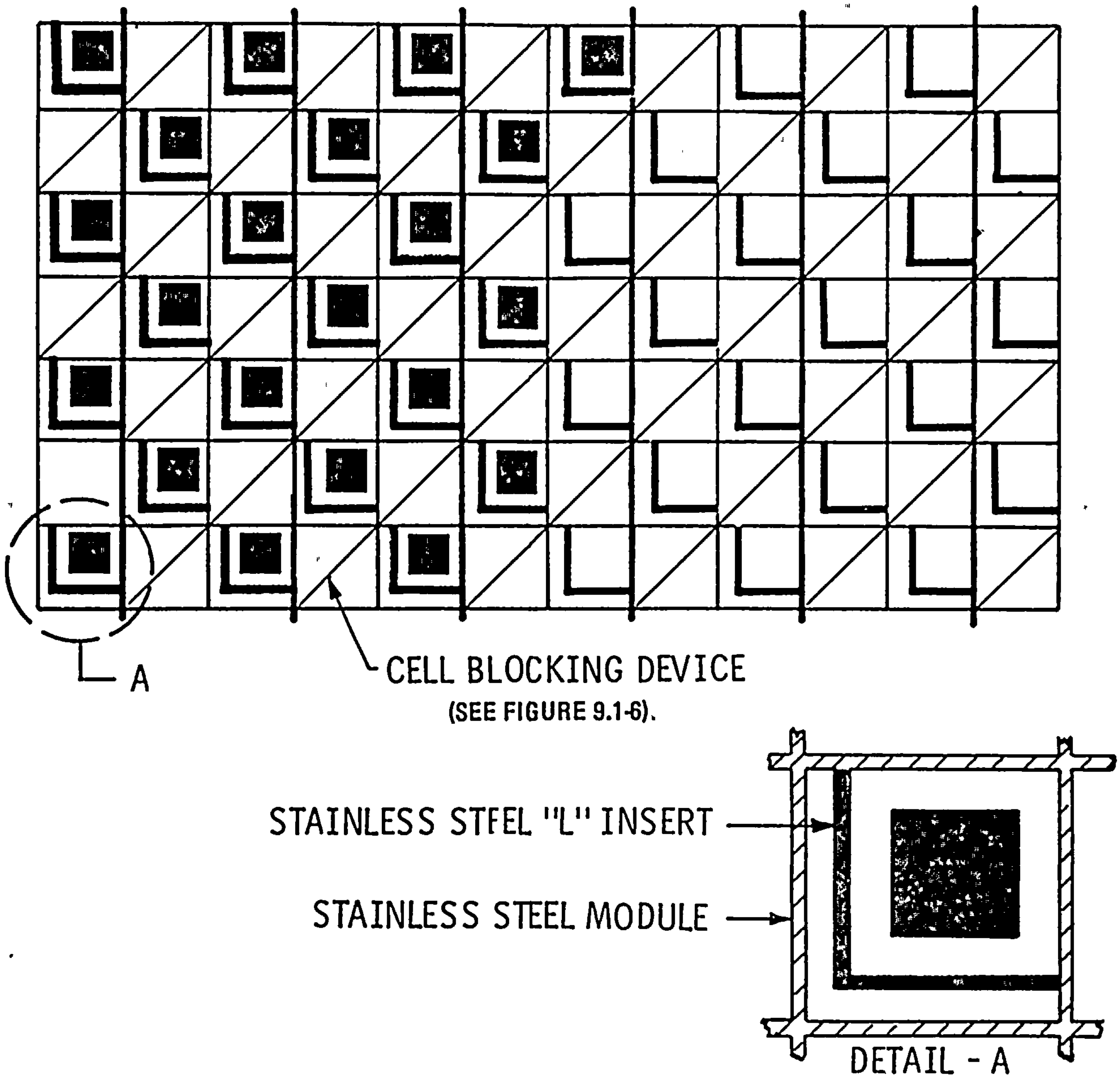
Palo Verde Nuclear Generating Station
Updated FSAR

FUEL STORAGE RACK
MODULE ASSEMBLY DETAILS
(Sheet 2 of 2)
Figure 9.1-6

FIGURE 1
Proposed Spent Fuel Pool Configuration



ARRANGEMENT OF STAINLESS STEEL "L" INSERTS AND CELL BLOCKING DEVICES



Palo Verde Nuclear Generating Station
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NEW OR SPENT FUEL
STORED IN A CHECKERBOARD ARRAY

Figure 9.1-5