ATTACHMENT A-1

Beaver Valley Power Station, Unit No. 1
Proposed Technical Specification Change No. 210
MARKED-UP PAGE

The following is a list of the affected page:

Affected Page: 5-4

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment building is designed and shall be maintained for a maximum internal pressure of 45 psig and a temperature of 280°F.

PENETRATIONS

5.2.3 Penetrations through the reactor containment building are designed and shall be maintained in accordance with the original design provisions contained in Section 5.2.4 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.3 REACTOR CORE

REPLACE WITH INSERT 1

FUEL ASSEMBLIES

5.3.1 The reactor core shall contain 157 fuel assemblies with each fuel assembly containing 264 fuel rods clad with zircaloy-4, except for fuel assemblies which may be reconstituted to replace fuel rods with non-fueled rods (e.g., zircaloy or stainless steel). Each fuel rod shall have a nominal active fuel length of 144 inches. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 4.5 weight percent U-235.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 48 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

(Proposed Wording)

INSERT 1

The reactor shall contain 157 fuel assemblies. Each assembly shall consist of a matrix of zirconium alloy fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

ATTACHMENT A-2

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 65
MARKED-UP PAGE

The following is a list of the affected page:

Affected Page: 5-6

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment building is designed and shall be maintained for maximum internal pressure of 45 psig and a temperature of 280.0°F.

PENETRATIONS

5.2.3 Penetrations through the reactor containment building are designed and shall be maintained in accordance with the original design provisions contained in Section 6.2.4 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.3 REACTOR CORE

FUEL ASSEMBLIES

REPLACE WITH INSERT 1

5.3.1 The reactor core shall contain 157 fuel assemblies with each fuel assembly containing 264 fuel rods clad with zircaloy-4. Each fuel rod shall have a nominal active fuel length of 144 inches. Reload fuel shall be similar in physical design to the initial core loading and shall have a maximum enrichment of 4.85 weight percent U-235.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 48 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The Reactor Coolant System is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR, with allowance for normal degradation pursuant to the applicable Surveillance Requirements,

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 680°F.

VOLUME

5.4.2 The total water and steam volume of the Reactor Coolant System is 9370 cubic feet at a nominal T_{avg} of 576°F.

(Proposed Wording)

INSERT 1

The reactor shall contain 157 fuel assemblies. Each assembly shall consist of a matrix of zirconium alloy fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

ATTACHMENT B

Beaver Valley Power Station, Unit Nos. 1 and 2
Proposed Technical Specification Change No. 210 and 65
REVISION OF DESIGN FEATURE 5.3.1

A. DESCRIPTION OF AMENDMENT REQUEST

The proposed amendment would modify Design Feature Section 5.3.1 to allow limited substitution of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with NRC approved applications of fuel rod configurations. These limitations are provided to reflect the guidance described in Generic Letter 90-02, Supplement 1.

B. BACKGROUND

Design Feature Section 5.3.1 provides a description of the fuel assemblies used in the reactor core. The Unit 2 description does not address fuel rod replacement, however, the Unit 1 description was modified by Amendment No. 104 to allow reconstitution to replace fuel rods with non-fueled rods (e.g., zircaloy or stainless steel). The NRC has since issued Generic Letter 90-02 and Supplement 1 to clarify the limitations on the application of currently NRC-approved analytical methods used in the analysis of reconstituted fuel.

C. JUSTIFICATION

The use of reconstituted fuel assemblies has been evaluated by Westinghouse as described in WCAP-13060-P, "Westinghouse Fuel Assembly Reconstitution Evaluation Methodology." The evaluation was performed to address the concerns identified in the generic letter and has been reviewed and approved by the NRC. The methodology described in the WCAP or other approved methodologies will be used for each cycle that reconstituted fuel assemblies are used. Design Feature Section 5.3.1 has been modified to incorporate the wording provided in Generic Letter 90-02, Supplement 1 to ensure consistency with NRC requirements.

D. SAFETY ANALYSIS

Fuel assembly reconstitution involves replacing leaking or damaged fuel rods with filler rods of stainless steel or zirconium alloy. This allows continued operation of fuel assemblies for further power production to recover fuel costs from fuel assemblies that would otherwise have to be discharged from the core. The technical specifications do not prohibit the reuse of fuel assemblies that have one or more leaking fuel rods. However, good operating practice recommends fuel assembly reconstitution to remove a potential source of radiation exposure from an increase in primary coolant fission product inventory.

The existing requirements of Design Feature Section 5.3.1 are being modified to reflect the wording recommended in Generic Letter 90-02, Supplement 1 and now also incorporated into the new Standard Technical Specifications (STS) Section 4.2.1. This new wording is consistent with the NRC staff position with respect to meeting the analytical requirements for fuel assembly reconstitution to ensure compliance with General Design Criteria (GDC) 10. The new Section 5.3.1 will allow fuel assembly reconstitution in accordance with NRC-approved applications of fuel rod configurations that are limited to those fuel designs that have been analyzed with applicable NRC staff-approved codes and methods, and shown by tests and analyses to comply with all fuel safety design bases. The change also allows the use of lead test assemblies without requiring a specific technical specification change. These limitations will ensure that those fuel configurations with reconstituted fuel are consistent with previously approved designs, and within existing acceptance criteria.

The UFSAR was reviewed and it was determined that a reconstituted fuel assembly is not significantly different from the other fuel assemblies and would not introduce an unreviewed safety question in the operation of the core. In addition, industry experience has shown that plant operation with reconstituted fuel assemblies is safe and that conformance to the technical specifications complies with the regulations to ensure the safe operation of the plant. The safety analyses for each core reload containing reconstituted fuel assemblies will be performed in accordance with the approved methodology, therefore, these changes have been determined to be safe and will not reduce the safety of the plant.

E. NO SIGNIFICANT HAZARDS EVALUATION

The no significant hazard considerations involved with the proposed amendment have been evaluated, focusing on the three standards set forth in 10 CFR 50.92(c) as quoted below:

> The Commission may make a final determination, pursuant to the procedures in paragraph 50.91, that a proposed amendment to an operating license for a facility licensed under paragraph 50.21(b) or paragraph 50.22 or for a testing facility involves no significant hazards consideration, if operation of the facility in accordance with the 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.

The following evaluation is provided for the no significant hazards consideration standards.

1. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

   The reconstituted fuel assemblies meet essentially the same design requirements and satisfy the same design criteria as other assemblies with similar operating history. The use of reconstituted fuel assemblies will not result in a reduction in any existing safety criteria or design limits. Reconstitution will tend to reduce the dose effect of some accidents by reducing or eliminating defective fuel rods that would otherwise contribute to an increase in primary coolant fission product inventory. Justification for the acceptability of replacing fuel rods with filler rods is determined by a cycle specific reload safety evaluation using an NRC approved methodology to verify that the safety criteria and design limits are met. This change is consistent with the requirements recommended in Generic Letter 90-02, Supplement 1 and the STS. This change does not affect the UFSAR and is consistent with the regulations, therefore, this change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Reconstituted fuel assemblies are designed, installed and used in the same manner as the other fuel assemblies in the core and all design and interface requirements remain unchanged. The use of reconstituted fuel assemblies has been evaluated by Westinghouse as described in WCAP-13060-P, "Westinghouse Fuel Assembly Reconstitution Evaluation Methodology." The evaluation was performed to address the concerns identified in Generic Letter 90-02 and Supplement 1 and has been reviewed and approved by the NRC. A reload core design with reconstituted fuel will evaluate the following issues: Mechanical Design, Nuclear Design, Thermal and Hydraulic Design, Non-LOCA Transient Analysis, LOCA Analysis, Steam Generator Tube Rupture and Containment Integrity Analysis. The reconstituted fuel assemblies will meet the design requirements in all these areas and will not introduce any new mode of plant operation or require any physical modification to the plant. Therefore, this change will not create the possibility of a new or different kind of accident from any accident previously evaluated in the UFSAR.

3. Does the change involve a significant reduction in a margin of safety?

   The safety and design limits will not be changed as a result of installing reconstituted fuel. All safety and design limits will continue to be confirmed in accordance with the reload safety evaluation methodology. Technical Specification 3/4.5 defines the ECCS performance criteria upon which the LOCA analyses are based and Technical Specification 2.1 defines the limiting safety system parameters which form the basis upon which the non-LOCA analyses are based. These criteria ensure that the plant remains within the limits of the safety analyses for all evaluated operating conditions, therefore, the margin of safety is not reduced.

F. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Based on the considerations expressed above, it is concluded that the activities associated with this license amendment request satisfies the no significant hazards consideration standards of 10 CFR 50.92(c) and, accordingly, a no significant hazards consideration finding is justified.

ATTACHMENT C-1

Beaver Valley Power Station, Unit No. 1
Proposed Technical Specification Change No. 210
TYPED PAGE

Applicable Typed Page

ATTACHMENT TO LICENSE AMENDMENT NO. ______

FACILITY OPERATING LICENSE NO. DPR-66

DOCKET NO. 50-334

Replace the following page of Appendix A, Technical Specifications, with the enclosed page as indicated. The revised page is identified by amendment number and contains a vertical line indicating the area of change.

Remove	Insert
5-4	5-4

(Proposed Wording)

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment building is designed and shall be maintained for a maximum internal pressure of 45 psig and a temperature of 280°F.

PENETRATIONS

5.2.3 Penetrations through the reactor containment building are designed and shall be maintained in accordance with the original design provisions contained in Section 5.2.4 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The reactor shall contain 157 fuel assemblies. Each assembly shall consist of a matrix of zirconium alloy fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 48 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

ATTACHMENT C-2

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 65
TYPED PAGES

Applicable Typed Pages

ATTACHMENT TO LICENSE AMENDMENT NO. ______

FACILITY OPERATING LICENSE NO. NPF-73

DOCKET NO. 50-412

Replace the following pages of Appendix A, Technical Specifications, with the enclosed pages as indicated. The revised pages are identified by amendment number and contain vertical lines indicating the areas of change.

Remove	Insert
5-6	5-6
5-7	5-7

(Proposed Wording)

DESIGN PRESSURE AND TEMPERATURE

5.2.2 The reactor containment building is designed and shall be maintained for maximum internal pressure of 45 psig and a temperature of 280.0°F.

PENETRATIONS

5.2.3 Penetrations through the reactor containment building are designed and shall be maintained in accordance with the original design provisions contained in Section 6.2.4 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.3 REACTOR CORE

FUEL ASSEMBLIES

5.3.1 The reactor shall contain 157 fuel assemblies. Each assembly shall consist of a matrix of zirconium alloy fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in nonlimiting core regions.

CONTROL ROD ASSEMBLIES

5.3.2 The reactor core shall contain 48 full length and no part length control rod assemblies. The full length control rod assemblies shall contain a nominal 142 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium and 5 percent cadmium. All control rods shall be clad with stainless steel tubing.

5.4 REACTOR COOLANT SYSTEM

DESIGN PRESSURE AND TEMPERATURE

5.4.1 The Reactor Coolant System is designed and shall be maintained:

a. In accordance with the code requirements specified in Section 5.2 of the FSAR, with allowance for normal degradation pursuant to the applicable Surveillance Requirements, 5.4 REACTOR COOLANT SYSTEM (Continued)

b. For a pressure of 2485 psig, and

c. For a temperature of 650°F, except for the pressurizer which is 680°F.

VOLUME

5.4.2 The total water and steam volume of the Reactor Coolant System is 9370 cubic feet at a nominal T_{avg} of 576°F.

5.5 EMERGENCY CORE COOLING SYSTEMS

5.5.1 The emergency core cooling systems are designed and shall be maintained in accordance with the original design provisions contained in Section 6.3 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirements.

5.6 FUEL STORAGE CRITICALITY

5.6.1 The spent fuel storage racks are designed and shall be maintained with a minimum of 10.4375 inch center-to-center distance between fuel assemblies placed in the storage racks. The fuel will be stored in accordance with the provisions described in FSAR Sections 4.3 and 9.1 to ensure a k_{eff} equivalent to ≤0.95 with the storage pool filled with unborated water.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 751'-3".

CAPACITY

5.6.3 The fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 1088 fuel assemblies.

5.7 SEISMIC CLASSIFICATION

5.7.1 Those structures, systems and components identified as Category I items in Section 3.7 of the FSAR shall be designed and maintained to the original design provisions with allowance for normal degradation pursuant to the applicant Surveillance Requirements.

5.8 METEOROLOGICAL TOWER LOCATION

5.8.1 The meteorological tower shall be located as shown on Figure 5.1-1.

ATTACHMENT D-1

Beaver Valley Power Station, Unit No. 1
Proposed Technical Specification Change No. 210

Applicable UFSAR Changes

the lateral spacing between the rods throughout the design life of the assembly. The grid assembly consists of an "egg-crate" arrangement of interlocked straps. The straps contain spring fingers and dimples for fuel rod support as well as coolant mixing vanes. The fuel rods consist of slightly enriched uranium dioxide ceramic cylindrical pellets contained in slightly cold worked Zircaloy-4 tubing which is plugged and seal welded at the ends to encapsulate the fuel. All fuel rods are pressurized with helium during fabrication to reduce stresses and strains to increase fatigue life.

Fuel assemblies may also contain non-fueled rods. Non-fueled rods may be used in core locations where fuel damage has occurred or may occur. The use of non-fueled rods began when fuel inspections performed during the fifth refueling outage identified leaking fuel rods in a peripheral assembly. It was determined that the fuel rod leakage was attributable to baffle jetting.

The solution to this problem, recommended by Westinghouse and used by other utilities, involves fuel assembly reconstitution as a means to allow the insertion of non-fueled rods into a fuel assembly. In the reconstitution process, the fuel rods in positions subject to problem conditions would be removed and replaced with non-fueled rods. The reconstituted fuel assemblies meet essentially the same design requirement as the original fuel assembly, and the use of reconstituted assemblies will not result in a change to existing safety criteria and design limits. INSERT 1

The center position in the assembly is reserved for the in-core instrumentation, while the remaining 24 positions in the array are equipped with guide thimbles joined to the grids and the top and bottom nozzles. Depending upon the position of the assembly in the core, the guide thimbles are used as core locations for rod cluster control assemblies, neutron source assemblies, and burnable absorber rods.

The bottom nozzle is a box-like structure which serves as a bottom structural element of the fuel assembly and directs the coolant flow distribution to the assembly.

The top nozzle assembly functions as the upper structural element of the fuel assembly in addition to providing a partial protective housing for the rod cluster control assembly or other components.

The rod cluster control assemblies consist of individual absorber rods fastened at the top end to a spider assembly. These assemblies contain full length absorber material to control the reactivity of the core under operating conditions.

The control rod drive mechanisms for the full length rod cluster control assemblies are of the magnetic latch type. The latches are controlled by three magnetic coils. They are so designed that upon a loss of power to the coils, the rod cluster control assembly is released and falls by gravity to shutdown the reactor.

INSERT 1

The effects of fuel assembly reconstitution are evaluated in accordance with the methods described in Reference 4.

INSERT 2

4. Slagle, W. H. (Ed.), "Westinghouse Fuel Assembly Reconstitution Evaluation Methodology," WCAP-13060, September 1991.

REFERENCES FOR SECTION 3.1

1. Davidson, S. L. (Ed.), et. al., "VANTAGE 5H Fuel Assembly," WCAP-10444-P-A, Addendum 2-A, February 1989.

2. Davidson, S. L. (Ed.), et. al., "VANTAGE 5 Fuel Assembly Reference Core Report," WCAP-10444-P-A, September 1985.

3. J. M. Hellman, et. al., "Fuel Densification, Experimental Results and Model for Reactor Application," WCAP-8218, Westinghouse Engineering Corporation (October 1973).

INSERT 2

ATTACHMENT D-2

Beaver Valley Power Station, Unit No. 2
Proposed Technical Specification Change No. 65

Applicable UFSAR Changes

is plugged and seal welded at the ends to encapsulate the fuel. All fuel rods are pressurized with helium during fabrication to reduce stresses and strains in order to increase fatigue life.

INSERT 1

The center array position in each assembly is reserved for the incore instrumentation, 24 additional positions in the array are equipped with guide thimbles joined to the grids and the top and bottom nozzles. Depending upon the position of the assembly in the core, the guide thimbles are used as core locations for rod cluster control assemblies (RCCAs), neutron source assemblies, and burnable absorber rods.

The bottom nozzle is a box-like structure which serves as a bottom structural support element of the fuel assembly and directs the reactor coolant into the flow channels of the assembly. The top nozzle assembly serves as the upper structural support element of the fuel assembly and provides a partial protective housing for the RCCA or other components.

The RCCAs each consist of a group of individual absorber rods fastened at the top end to a structure called a spider assembly. These absorber rods contain absorber material to control the reactivity of the core under operating conditions.

The nuclear design analyses and evaluation establish physical locations for control rods, burnable absorber assemblies, and physical parameters such as fuel enrichments and boron concentration in the reactor coolant. The nuclear design analyses establish that the reactor core and the reactor control system satisfy all design criteria, even if the highest reactivity worth RCCA is in the fully withdrawn position. The core has inherent stability against diametral and azimuthal power oscillations. Axial power oscillations which may be induced by load changes and resultant transient xenon may be suppressed by the use of RCCAs.

The thermal-hydraulic design analyses establish reactor coolant flow parameters which assure that adequate heat transfer is provided between the fuel clad and the reactor coolant. The thermal design takes into account local variations in dimensions, power generation, flow distribution, and mixing. The mixing vanes incorporated in the fuel assembly spacer grid design induce additional flow-mixing between the various flow channels within a fuel assembly as well as between adjacent assemblies.

The performance of the core is monitored by excore neutron detectors, movable incore neutron detectors, and thermocouples at the outlet of selected fuel assemblies.

INSERT 1

Fuel assemblies may also contain non-fueled rods. Non-fueled rods may be used in core locations where fuel damage has occurred or may occur. The use of non-fueled rods began when fuel inspections performed during the third refueling outage identified leaking fuel rods. The solution to this problem, recommended by Westinghouse and used by other utilities, involves fuel assembly reconstitution as a means to allow the insertion of non-fueled rods into a fuel assembly. In the reconstitution process, the fuel rods in positions subject to problem conditions would be removed and replaced with non-fueled rods. The reconstituted fuel assemblies meet essentially the same design requirement as the original fuel assembly, and the use of reconstituted assemblies will not result in a change to existing safety criteria and design limits. The effects of fuel assembly reconstitution are evaluated in accordance with the methods described by Slagle 1991.

INSERT 2

Slagle, W. H. (Ed.), 1991. "Westinghouse Fuel Assembly Reconstitution Evaluation Methodology," WCAP-13060-P, September 1991.

INSERT 3

Fuel rods may be replaced by non-fueled rods. For a description of non-fueled rods, see Section 4.1.

INSERT 4

Some fuel assemblies may contain non-fueled rods. For a description of non-fueled rods see Section 4.1.

Table 4.1-1 presents a comparison of the principal nuclear, thermal-hydraulic, and mechanical design parameters for Beaver Valley Power Station-Unit 2 (BVPS-2) and the Virgil C. Summer Nuclear Station (NRC Docket No. 50-395).

The effects of fuel densification are evaluated with the methods described by Hellman (1975). The BVPS-2 position with respect to Regulatory Guide 1.126 is given in Section 1.8

The analytical techniques employed in the core design are tabulated in Table 4.1-2.

4.1.2 Reference for Section 4.1

Davidson, S.L. (Ed.), et al, "VANTAGE 5H Fuel Assembly," WCAP-10444-P-A, Addendum 2-A, February 1989.

Davidson, S.L. (Ed.), et al, "VANTAGE 5H Fuel Assembly Reference Core Report," WCAP-10444, September 1985.

Hellman, J. M. (Ed.) 1975. Fuel Densification Experimental Results and Model and Reactor Application. WCAP-8218-P-1 (Proprietary) and WCAP-8219-A (Non-Proprietary).

INSERT I

flow so that the heat transfer performance requirements can be met for all modes of operation.

The following section provides the fuel system design bases and design limits. This information, augmented by the clarifying information submitted to the USNRC during their review of Westinghouse Topical Report, WCAP-10444-A, Addendum 2-A, "VANTAGE 5H Fuel Assembly" (W. J. Johnson (Westinghouse) to M. W. Hodges (NRC), Letter No. NS-NRC-88-3319, dated April 15, 1988. W. J. Johnson (Westinghouse) to M. W. Hodges (NRC), Letter No. NS-NRC-88-3363, dated July 29, 1988.) provide information consistent with the acceptance criteria of the Standard Review Plan (SRP) 4.2.

4.2.1 Design Bases

INSERT 3

The fuel rod and fuel assembly design bases are established to satisfy the general performance and safety criteria presented in Section 4.2.

The detailed fuel rod design established such parameters as pellet size and density, clad/pellet diametral gap, gas plenum size, and helium pre-pressurization level. The design also considers effects such as fuel density changes, fission gas release, clad creep, and other physical properties which vary with burnup. The integrity of the fuel rods is ensured by designing to prevent excessive fuel temperatures, excessive internal rod gas pressures due to fission gas releases, and excessive cladding stresses and strains. This is achieved by designing the fuel rods so that the conservative design bases in the following subsections are satisfied during ANS Condition I and ANS Condition II events over the fuel lifetime. For each design basis, the performance of the limiting fuel rod must not exceed the limits specified by the design basis.

Integrity of the fuel assembly structure is ensured by setting limits on stresses and deformations due to various loads and by preventing the assembly structure from interfering with the function of other components. Three types of loads are considered.

1. Nonoperational loads such as those due to shipping and handling.

2. Normal and abnormal loads which are defined for ANS Conditions I and II.

detectors can be activated to provide more detailed information. In all proposed cores, these horizontal plane oscillations are self-damping by virtue of reactivity feedback effects designed into the core.

Axial xenon spatial power oscillations may occur late in core life. The control bank and excore detectors are provided for control and monitoring of axial power distributions. Assurance that fuel design limits are not exceeded is provided by reactor overpower ΔT and overtemperature ΔT trip functions which use the measured axial power imbalance as an input.

4.3.1.7 Anticipated Transients Without Trip

The effects of anticipated transients with failure to trip are not considered in the design bases of the plant. Analysis has shown that the likelihood of such a hypothetical event is negligibly small. Furthermore, analysis of the consequences of a hypothetical failure to trip following anticipated transients has shown that no significant core damage would result, system peak pressures would be limited to acceptable values, and no failure of the reactor coolant system would result (Westinghouse 1974).

4.3.2 Description

4.3.2.1 Nuclear Design Description

The reactor core consists of a specified number of fuel rods which are held in bundles by spacer grids and top and bottom nozzles. The fuel rods are constructed of cylindrical Zircaloy tubes containing UO_2 fuel pellets. The bundles, known as fuel assemblies, are arranged in a pattern which approximates a right circular cylinder.

INSERT 4

Each fuel assembly contains a 17 x 17 rod array composed of 264 fuel rods, 24 rod cluster control thimbles, and an incore instrumentation thimble. Figure 4.2-1 shows a cross-sectional view of a 17 x 17 fuel assembly and the related rod cluster control locations. Further details of the fuel assembly are given in Section 4.2.

The fuel rods within a given assembly have the same uranium enrichment in the radial plane. However, the uranium enrichment may change with fuel height (e.g., the fuel assemblies may use unenriched uranium fuel in the top and bottom six inches of the fuel rods. The middle 120 inches of each assembly would then contain the enriched uranium fuel). Fuel assemblies of several different enrichments are used in the core loading to establish a favorable radial power distribution.

The reference reloading pattern is typically similar to Figure 4.3-1 with depleted fuel interspersed checkerboard style in the center and