UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

February 9, 1971

Docket No. 50-155

Consumers Power Company
ATTN: Mr. Gerald J. Walke
Nuclear Fuel Management
Administrator
212 West Michigan Avenue
Jackson, Michigan 49201

Change No. 21
License No. DPR-6

Gentlemen:

By letters dated December 15 and 17, 1970, Consumers Power Company requested changes to the Technical Specifications of Facility License No. DPR-6 to permit reactor operation with Reload-F (Proposed Change No. 21) and "Type J-1" (Proposed Change No. 22) fuel assemblies in the core. Both types of fuel assemblies are essentially identical to the Reload E-G fuel assemblies which were approved for the Big Rock Point core by Change No. 16 issued on February 27, 1969. We have consolidated the requests as Proposed Change No. 21.

According to the proposed changes, the differences between Reload-F and E-G fuel are small variations in the fuel and poison distribution and repositioning of the four tie rods in the Reload-F fuel assemblies. The difference between the "Type J-1" fuel assemblies provided by Jersey Nuclear Company and the approved E-G fuel assemblies fabricated by General Electric is the use of short diffusers in the "Type J-1" fuel at the tie plate inlet to streamline the flow after the coolant leaves the flow distribution orifices.

Based on our evaluation of the changes that have been described by the Consumers Power Company, we have concluded that use of the proposed fuel assemblies in the Big Rock Point core does not present a change in the hazards considerations described or implicit in the safety analysis report and there is reasonable assurance that the health and safety of the public will not be endangered by the operation of the Big Rock Point Nuclear Reactor with Reload-F and "Type J-1" fuel bundles in the core.

Accordingly, pursuant to Section 50.59 of 10 CFR Part 50, the Technical Specifications of Facility License No. DPR-6 are hereby changed as indicated in Attachment A to this letter. For clarification and correctness, minor revisions of the proposed changes have been made as agreed by your representative.

Sincerely,

Peter A. Morris

Peter A. Morris, Director
Division of Reactor Licensing

Enclosure:
Attachment A - Changes to
Technical Specifications

cc: George F. Trowbridge, Esquire
Shaw, Pittman, Potts, Trowbridge & Madden
910 - 17th Street, N. W.
Washington, D. C. 20006

ATTACHMENT A

CHANGE NO. 21 TO TECHNICAL SPECIFICATIONS

FACILITY LICENSE NO. DPR-6

CONSUMERS POWER COMPANY

DOCKET NO. 50-155

1. Section 5 Figures:

   A. Delete Figure 5.2, "Original A fuel"

   B. Transfer existing Figures 5.5 (8 x 8 Fuel Lattice Centermelt Bundle), 5.6 (7 x 7 Fuel Lattice Centermelt Bundle), 5.8 (Modified E-G Fuel), and 5.9 (EEI-$OU_2$-$PuO_2$ Fuel), to a new section 8 and renumber as Figures 8.1, 8.2, 8.3, and 8.4, respectively.

   C. Renumber the following Figures:

      Figure 5.3, "Reload-B fuel", to Figure 5.2
      Figure 5.4, "Reload-C fuel", to Figure 5.3
      Figure 5.7, "Reload-E and E-G fuel", to Figure 5.4

   D. Add the attached Figure 5.5, "Reload-F fuel"

   E. Add the attached Figure 5.6, "Type 'J-1' fuel"

2. Section 5.1.5.(c) - Change to read:

   "(c) Fuel Bundles

   The general design and configuration of the six types of reload fuel bundles should be as shown in Figures 5.2 through 5.6 (inclusively) of the specifications. Principal design features shall be as shown in Table 5.1."

3. Section 5.1.5 - Delete the present table and substitute the attached table, now designated Table 5.1.

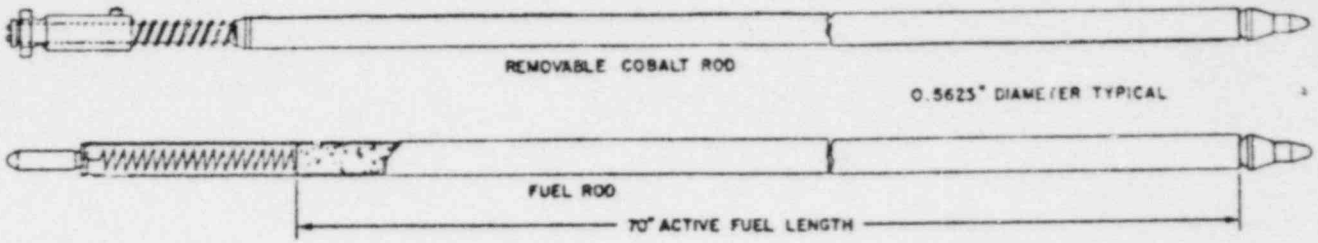
4. Sections 5.1.7, 5.1.8 and 5.1.9 are transferred to a new Section 8.

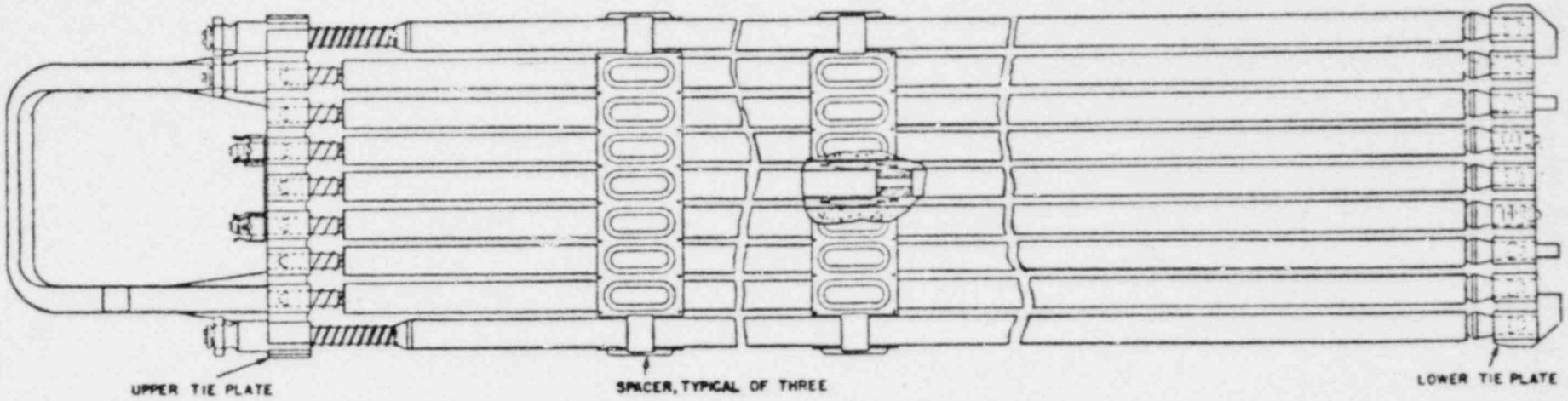
5. Section 5.2.1.(b) - Change to read:

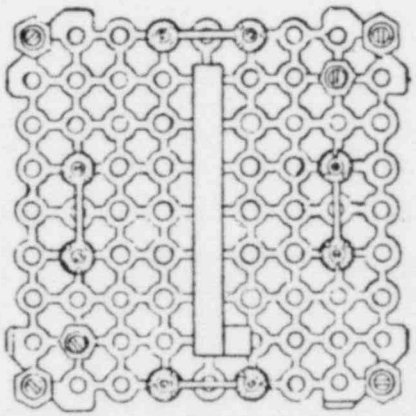
   "(b) Reactor Operation

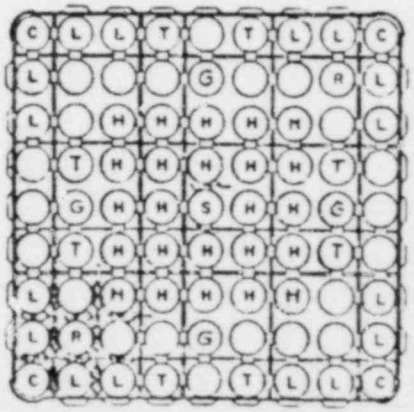
   The reactor operation shall be so limited as to be consistent with the most conservative of parameters in Table 5.2 and Table 8.2."

6. Section 5 - Add the attached Table 5.2.





S – SPACER CAPTURE ROD (HIGH ENRICHMENT)
H – HIGH ENRICHMENT RODS
– MIDDLE ENRICHMENT RODS
T – TIE RODS (MIDDLE ENRICHMENT)
L – LOW ENRICHMENT POWER CORRECTION RODS
C – REMOVABLE COBALT RODS
R – REMOVABLE FUEL RODS (MIDDLE ENRICHMENT)
G – GADOLINIA RODS (MIDDLE ENRICHMENT)

Figure 5.5
BIG ROCK POINT F FUEL

(Issued with Change No. 21 dated February 9, 1971

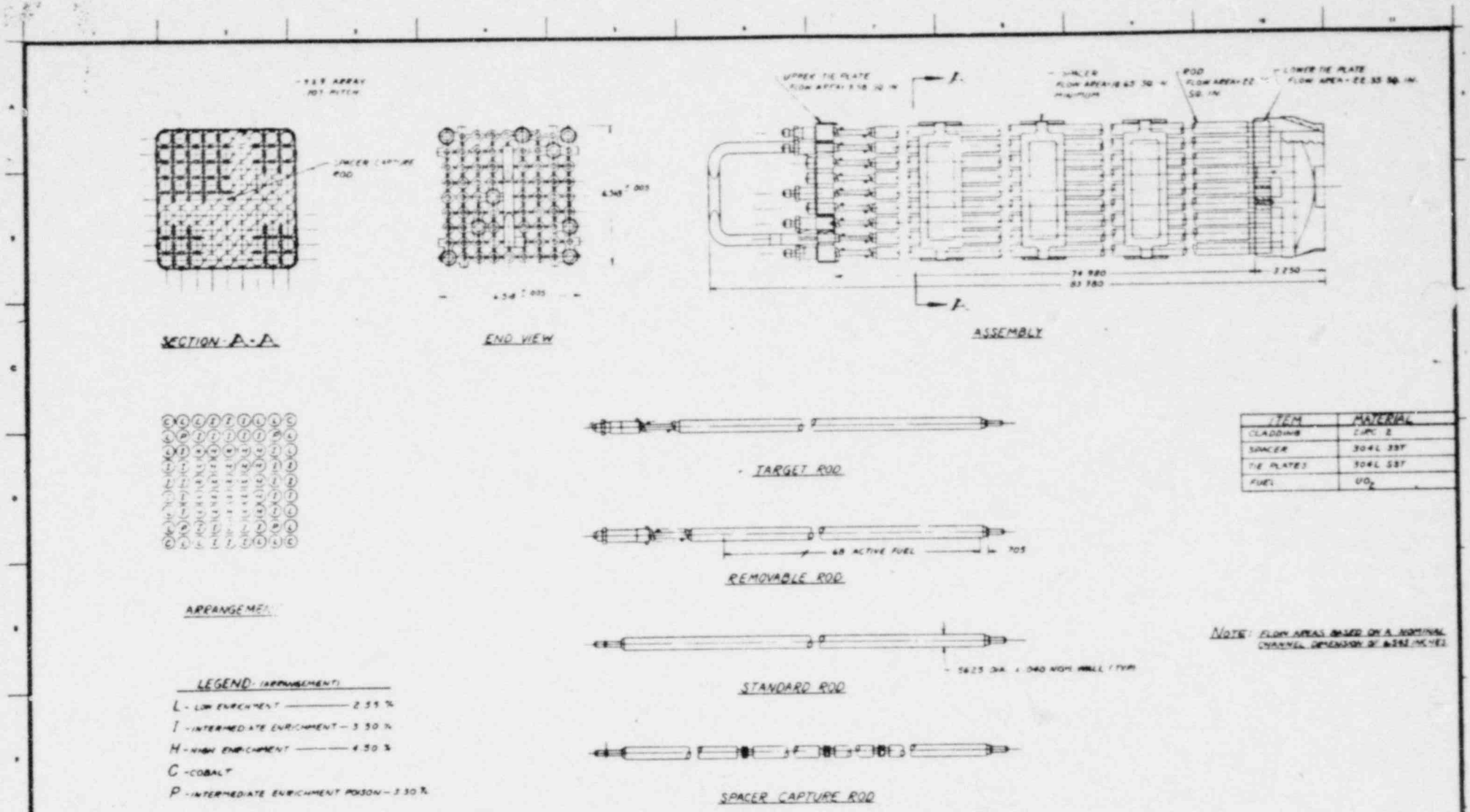



Figure 5.6 Big Rock Point Type "J-1" Fuel (Issued with Change No. 21

TABLE 5.1

| General | RELOAD FUEL TYPES<br>Reload (B & C) | Reload (E) | Reload (E-G & F) | J-1 |
|---|---|---|---|---|
| Geometry, Fuel Rod Array | 11 x 11 | 9 x 9 | 9 x 9 | 9 x 9 |
| Rod Pitch, Inch | 0.577 | 0.707 | 0.707 | 0.707 |
| Standard Fuel Rods per Bundle | 109 | 74 | 70 | 67 |
| Special Fuel Rods per Bundle | 12(1) | 7(1, 2) | 11(1, 2, 3) | 14(6) |
| Spacers per Bundle | 5 | 3 | 3 | 3 |
| **Fuel Rod Cladding** | | | | |
| Material | Zr-2 | Zr-2 | Zr-2 | Zr-2 |
| Standard Rod Tube Wall, Inch | 0.034 | 0.040 | 0.040 | 0.040 |
| Special Rod Tube Wall, Inch | 0.031 | 0.040 | 0.040 | 0.040 |
| **Fuel Rods** | | | | |
| Standard Rod Diameter, Inch | 0.449 | 0.5625 | 0.5625 | 0.5625 |
| Special Rod Diameter, Inch | 0.344 | 0.5625 | 0.5625 | 0.5625 |
| Fuel Stacked Density, Percent Theoretical | 94 ± 1 Pellet<br>85 Powdered | 90-95 Pellet(5) | 94 Pellet(4, 5) | 91(7) |
| Active Fuel Length, Inches | | | | |
| Standard Rod | 70 | 69.75 | 70 | 68 |
| Special Rod | | 64.6 Central | 64.9 Central | 62.2 Central |
| Fill Gas | Helium | Helium | Helium | Helium ≥95% |

(1) Reload B, C, E, E-G and F fuel bundles may contain (in the corner regions of the bundle) four Zr-2 tubes having encapsulated cobalt targets sealed within.

(2) Fuel bundles have a special central fuel rod to which the bundle spacers are fixed. In addition, two of the interior bundle fuel rods are removable and may contain $UO_2$-$PuO_2$ fuel.

(3) In addition to special rods for Reload E, Reload E-G and F have four gadolinia-containing rods.

(4) With 3% dishing on selected rods.

(5) $UO_2$-$PuO_2$ fuel rod stack density will vary from 74 to 92% theoretical by using annular, dished, or nondished pellets in selected rods.

(6) This includes: 4 gadolinia-containing rods, one of which is removable, 4 removable cobalt bearing corner rods, 5 removable rods and one central spacer capture rod.

(7) Pellets are dished 3% of undished volume.

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TABLE 5.2

| | "B" & "C" Fuel | RELOAD 'E', 'E-G', 'F' & 'J-1' |
|---|---|---|
| *Minimum Core Burnout Ratio at Overpower | 1.5 | 1.5 |
| Transient Minimum Burnout Ratio in Event of Loss of Recirculation Pumps from Rated Power | 1.5 | 1.5 |
| Maximum Heat Flux at Overpower, Btu/hr-ft$^2$ | 530,000 | 500,000 |
| Maximum Steady-State Heat Flux, Btu/hr-ft$^2$ | 434,000 | 410,000 |
| Maximum Fuel Rod Power at Overpower, kW/ft | 17.2 | 21.6 |
| Maximum Steady-State Fuel Rod Power, kW/ft | 14.2 | 17.7 |
| Stability Criterion: Maximum Measured Zero-to-Peak Flux Amplitude, Percent of Average Operating Flux | 20 | 20 |
| Maximum Steady-State Power Level, MWt | 240 | 240 |
| Maximum Value of Average Core Power Density @ 240 MWt, kW/L | 46 | 46 |
| Maximum Reactor Pressure During Power Operation, psig | 1485 | 1485 |
| Minimum Recirculation Flow Rate, lb/hr (Except During Pump Trip Tests or Natural Circulation Tests as Outlined in Section 8) | $6 \times 10^6$ | $6 \times 10^6$ |
| Maximum MWd/T of Contained Uranium for an Individual Bundle | 23,500 | 23,500 |
| Rate of Change of Reactor Power During Power Operation: | | |

Control rod withdrawal during power operation shall be such that the average rate of change of reactor power is less than 50 MWt per minute when power is less than 120 MWt, less than 20 MWt per minute when power is between 120 and 200 MWt, and 10 MWt per minute when power is between 200 and 240 MWt.

*Based on correlation given in "Design Basis for Critical Heat Flux Condition in Boiling Water Reactors" by J. M. Healzer, J. E. Hench, E. Janssen, and S. Levy, September 1966 (APED 5286 and APED 5286, Part 2).

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7. Section 8 - Change to read:

"8.0 RESEARCH AND DEVELOPMENT

From time to time, various developmental types of fuel will be irradiated in the Big Rock Point reactor. This section will describe these fuel types and any operating limitations associated therewith.

8.1 Developmental Fuel Design Features

The general dimensions and configurations of the developmental fuel designs shall be as shown in Figures 8.1 through 8.4. Principal design features shall be essentially as on Table 8.1.

8.1.1 Zr-Cr Alloy Test Bundle

One of the reload fuel bundles may contain up to 18 rods (2 dummy and 16 fuel rods) clad with an annealed Zr + 1.15 w/o Cr alloy and up to 8 rods (2 dummy and 6 fuel rods) clad with annealed special Zr-2. The remaining fuel rods in the bundle (maximum of 95) shall be clad with cold-worked standard Zr-2.

8.1.2 Thin Clad Powder Fuel Bundle

Two the the Reload 'C' fuel bundles may contain standard rods with Zr-2 cladding of 0.025" thickness; otherwise, they will be the same as the remaining Reload 'C' fuel bundles.

8.2 Principal Developmental Fuel Operating Limitations

The reactor operation shall be so limited as to be consistent with the most conservative of parameters in Table 5.2 and Table 8.2.

8.2.1 Centermelt Test Fuel Bundles

(a) Operating Limitations

Six fuel bundles may be operated at increased thermal output with various amounts of centermelting of the $UO_2$.

The fuel shall be specially designed for this operation and shall be permitted to exceed the general core operating limitations of Section 5.2.1.(b) but shall be limited to the most conservative of the parameters listed on Table 8.2.

(b) Rate of Power Level Change

Control rod withdrawal shall be limited as in Section 5.2.1. In addition, when centermelt fuel is in the core, the rate of power increase between 170 MWt and 240 MWt shall be limited to 1/2 MWt average per minute per notch of control rod withdrawal when any of the following conditions exist: (1) A centermelt fuel bundle is being brought to power for the first time, or (2) a scram recovery is being made at a time in the xenon transient when the peak of the axial power distribution is lower in the core than the peak existing at the time of the last shutdown.

(c) Fuel Examinations

Nondestructive examinations of each fuel rod in the centermelt fuel bundles shall be performed during each core refueling period. Any rods displaying unexpected increases in diameter shall not be returned to the core.

Selected fuel rods shall be removed during each refueling period for destructive examinations. When the first rods are removed for destructive examination at about 15% expected lifetime, the 4 advanced performance bundles shall be removed from the core. These assemblies shall not be returned to the core until the results of the destructive examinations have been evaluated and it is confirmed that the design performance of the fuel has been met and continued irradiation can be safely accomplished.

(d) Supplemental Core Cooling

During irradiation of centermelt fuel bundles, a supplemental system for core cooling shall be provided. This system shall provide a means of introducing fire water into the reactor pressure vessel independent of the core spray system."

Table 8.1

| General | RESEARCH AND DEVELOPMENT FUEL TYPES<br>Centermelt Intermediate | Centermelt Advanced | "Modified E-G" | EEI $UO_2$-$PuO_2$ |
|---|---|---|---|---|
| Geometry, Fuel Rod Array | 8 x 8 | 7 x 7 | 9 x 9 | 9 x 9 |
| Rod Pitch, Inch | 0.807 | 0.921 | 0.707 | 0.707 |
| Standard Fuel Rods per Bundle | 36 | 29 | 52 | 0 |
| Special Fuel Rods per Bundle | 28(3) | 20(3) | 29(1, 2, 4) | 81(6, 7) |
| Spacers per Bundle | 5 | 5 | 3 | 3 |
| **Fuel Rod Cladding** | | | | |
| Material | Zr-2 | Zr-2 | Zr-2 With Various Initial Mechanical Properties | Zr-2 |
| Standard Rod Tube Wall, Inch | 0.035 | 0.040 | Zr-3Nb-1Sn 0.040 | - |
| Special Rod Tube Wall, Inch | 0.035 | 0.040 | 0.040 | 0.040 |
| **Fuel Rods** | | | | |
| Standard Rod Diameter, Inch | 0.570 | 0.700 | 0.5625 | - |
| Special Rod Diameter, Inch | 0.570 | 0.700 | 0.5625 | 0.5625 |
| Fuel Stacked Density, Percent Theoretical | 94 Pellet<br>85 Powder | 94 Pellet<br>85 Powder | 94 Pellet(5) | 82 |
| Active Fuel Length, Inches | | | | |
| Standard Rod | 66-67.3 | 65-66.3 | 70 | 70 |
| Special Rod | | | 64.9 Central,<br>68.6 Removable | |
| Fill Gas | Helium | Helium | Helium | Helium |

(1) Modified E-G and EEI $UO_2$-$PuO_2$ fuel bundles may contain (in the corner regions of the bundle) four Zr-2 tube having encapsulated cobalt targets sealed within.

(2) Modified E-G and EEI $UO_2$-$PuO_2$ fuel bundles have a special central fuel rod to which the bundle spacers are fixed. In addition, two of the interior bundle fuel rods are removable and may contain $UO_2$-$PuO_2$ fuel.

(3) Special rods have depleted uranium.

(4) Also has four gadolina-containing rods.

(5) With 3% dishing on selected rods.

(6) $UO_2$-$PuO_2$ fuel rod stack density will vary from 74 to 92% theoretical by using annular, dished, or nondished pellets in selected rods.

(7) Sixty-four $UO_2$-$PuO_2$ rods similar to standard $UO_2$ rods, four removable $PuO_2$ rods, eight gadolinia-containing rods, four cobalt corner rods and one empty (water-filled during operation) spacer rod.

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Table 8.2

| | "EEI $UO_2$-$PuO_2$, and 'Modified E-G' Fuels" | Centermelt | |
|---|---|---|---|
| | | Intermediate | Advanced |
| *Minimum Core Burnout Ratio at Overpower | 1.5 | 1.5 | 1.5 |
| Transient Minimum Burnout Ratio in Event of Loss of Recirculation Pumps From Rated Power | 1.5 | 1.5 | 1.5 |
| Maximum Heat Flux at Overpower, Btu/Hr-$Ft^2$ | 500,000 | - | - |
| Maximum Steady State Heat Flux, Btu/Hr-$Ft^2$ | 410,000 | 500,000 | 500,000 |
| Maximum Fuel Rod Power at Overpower, kW/Ft | 21.6 | - | - |
| Maximum Steady State Fuel Rod Power, kW/Ft | 17.7 | 21.8 | 26.8 |
| Stability Criterion: Maximum Measured Zero-to-Peak Flux Amplitude, Percent of Average Operating Flux | 20 | - | - |
| Maximum Steady State Power Level, $MW_t$ | 240 | - | - |
| Maximum Value of Average Core Power Density at 240 $MW_t$, kW/L | 46 | - | - |
| Maximum Reactor Pressure During Power Operation, Psig | 1,485 | - | - |
| Minimum Recirculation Flow Rate, Lb/Hr (Except During Pump Trip Tests or Natural Circulation Tests as Outlined in Section 8) | $6 \times 10^6$ | - | - |
| Maximum MWd/T of Contained Uranium for an Individual Bundle | 23,500 | - | - |
| Number of Bundles | | | |
| Pellet $UO_2$ | - | 1 | 2 |
| Powder $UO_2$ | - | 1 | 2 |

Rate of Change of Reactor Power During Power Operation:

Control rod withdrawal during power operation shall be such that the average rate of change of reactor power is less than 50 $MW_t$ per minute when power is less than 120 $MW_t$, less than 20 $MW_t$ per minute when power is between 120 and 200 $MW_t$, and 10 $MW_t$ per minute when power is between 200 and 240 $MW_t$.

*Based upon critical heat flux correlation, APED-5286.

2/9/71

Distribution
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Based on our evaluation of the changes that have been described by the Consumers Power Company, we have concluded that use of the proposed fuel assemblies in the Big Rock Point core does not present a change in the hazards considerations described or implicit in the safety analysis report and there is reasonable assurance that the health and safety of the public will not be endangered by the operation of the Big Rock Point Nuclear Reactor with Reload-F and "Type J-1" fuel bundles in the core.

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Sincerely,

Peter A. Morris, Director
Division of Reactor Licensing

Enclosure:
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Technical Specifications

cc: George F. Trowbridge, Esquire
Shaw, Pittman, Potts, Trowbridge & Madden
910 - 17th Street, N. W.
Washington, D. C. 20006

| OFFICE ▶ | DRL | DRL | DRL | DRL | DRL | DRL |
|---|---|---|---|---|---|---|
| SURNAME ▶ | JJShea:sjg | RMDiggs | DLZiemann | DJSkovholt | FSchroeder | PAMorris |
| DATE ▶ | 2/5/71 | 2/5/71 | 2/5/71 | 2/5/71 | 2/8/71 | 2/9/71 |

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